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J. F. Steadman

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It is not without interest to learn that sunlight can be depended upon, and employed for ophthalmoscopic work altogether in another country, Dr. Macdonald, ophthalmic surgeon to the Demilt Dispensary of New York, having sent me the following observations on

THE SUN-OPHTHALMOSCOPE.

“The use of sunlight instead of artificial light in ophthalmoscopy first suggested itself to me about a year ago, as a means of examining the patients attending the Institution to which I am attached, and in which I had no facilities for examining by the ordinary method. The advantages which I have found it to possess are such that I now prefer to use it in my private practice. Of course, the plane or concave mirrors hitherto used could not be employed with sunlight, as its intensity would be too great; *convex* mirrors, however, by diverging the rays of light reflected from them, diminish its intensity, and the sun’s rays reflected by such mirrors can be easily borne. Those that I employ are of glass, about one inch in diameter, have curves, one of 4, and one of 8 inches radius, and from their centres a disk of the silvering, about $\frac{1}{2}$ of an inch in diameter, is removed. With photophobic cases, the weakest mirror, *i.e.* the one having the greatest curve, is used; in ordinary cases I use the other. The patient is seated in, and with his back to, the sun, and the surgeon proceeds as with the ordinary ophthalmoscope.

“Sunlight is much superior to other means of illumination, its intensity may be increased to any extent, and with it

the fundus of the eyeball is seen of a more natural colour and appearance. By the use of convex mirrors, the field of the retina illuminated is much greater than when concave instruments are employed ; for this reason, this instrument is much less difficult to use than others, and a tyro will distinguish all the points of interest in the retina at his first attempt. Dr. W. Zehender, in the first volume of the 'Archiv für Ophthalmologic,' first proposed the use of convex mirrors, but only with artificial light."

In this country, especially perhaps in London, sunlight is too uncertain for us to think of its being commonly used ; but I recollect, that some years ago, in the case of a foreign body to be removed from the vitreous space, I availed myself of the sunlight for a final examination in the operating room: the sun was shining dimly through a fog, so that I could use the concave mirror we have for an ordinary lamplight examination without distressing the patient, and with very effective illumination for my inquiry. It may be worth consideration for sunlight ophthalmoscopists who prefer, or who happen to have the ordinary concave mirrors adapted for lamplight examinations, that the same should be used with sunlight, as it could be easily and well qualified, I suppose, by diminution of the too great illuminating power it had at any time. For this purpose, the patient might be seated with an upright screen attached to the high back of his chair, and thus would be protected from the heat of the sun, and on either side of the screen might be a shutter, to adjust, by sliding up and down to the height of the patient's head, with an aperture at which the sunlight would be admitted, and its extra power of illumination there reduced and regulated by one or more white curtains of erape or muslin.

J. F. S.

VARIOUS OPHTHALMOSCOPIC APPEARANCES OF THE VESSELS OF THE OPTIC DISK, WHEN EXCAVATED.

An optical illusion may be observed with the ordinary ophthalmoscope (the biconvex lens being used) when the optic nerve is "cupped." In a case of mine in which it was particularly observable, the *media* being clear and the "cup" deep, I have drawn the entrance of the optic nerve in three different conditions, and given diagrams to illustrate the various appearances of the illusion of which I speak.

The case was in appearance one of those called "amaurosis with excavation of the optic nerve."

Michael Giles, able seaman, aged 30, came to me at Moorfields, on March 19th, 1860, complaining of his left eye, in which his vision was so much impaired, that, although he said it did not trouble him himself, as his right eye was sound, the captain of his vessel had discovered it and complained of him because sometimes, in a dim light, he could not well see the compass at the binnacle.

In the left eye there was a nebula, but only near the inner and lower margin of the cornea; the iris was tremulous; the pupil was circular, of fair size or rather large, responding tolerably to the influence of light; there was no external evidence of inflammation past or present; the globe was of about normal tension: he could only tell fingers or other large objects held near it. The right eye appeared altogether healthy, and with it he could see well at average distances.

His history was, that his sight in either eye was quite perfect until six months previously when he had received a violent blow of a shovel on the temporal side of the left orbit; he was stunned and taken to the London Hospital: he had not his right senses, was blistered, and took pills: he had great pain in the head and eye, the latter was very painful, and afterwards very sensitive to light, however he soon left the hospital quite well, excepting occasional headaches which he did not lose for some weeks afterwards, and but for indistinctness of vision, of the left eye only, he thought he had quite recovered. He went back to sea for two months, again for about the same length of time, and made a third voyage of six weeks, after which he came to the hospital for the reason I have mentioned: he had not remarked that in either voyage his sight had become much worse: he had had no pain and did not seem to be in any trouble about it. Sometimes, especially in the evenings, he had seen "like sparks," or a "cloud" passing over the eye for a few minutes together.

I put atropine to both eyes: the right eye presented nothing noteworthy, but a slight congestion of the entrance of the optic nerve: the left showed a very deep cup (Plate XI, X, Y, Z) with two veins (X, Z) passing out, and one artery passing in by it; the pulse could be detected in the latter by a close examination; the vessels dipped over the edge and curved down the sides of the cup with a perspective appearance: slight pressure on the globe stopped the circulation in the veins. There were two marks, like separations or ruptures of the choroid, showing through them the sclerotic below (above) the entrance of the optic nerve: one close to it (*a.b.*) having a curve corresponding to about a quarter of a circle of which the optic nerve was the centre, and another also curved to the same centre but more remote from it, nearer the yellow spot, and of less extent.

Pulsation being visible and all the vessels somewhat pressed against the margin of the optic nerve, I admitted the patient thinking to perform iridectomy. He had the full diet of the hospital, and, of course, complete rest besides belladonna used for the ophthalmoscopic examinations, and before I did the operation the pulsation was no longer visible without pressure exerted on the globe, and vision in this eye had improved so that (especially as the indications were never very promising) I did not operate, the patient being contented, and he left the hospital to go to sea again, although I had advised him to engage in some other employment. He never allowed that at sea he had been worked very hard, or had lived badly.

First—*of the illusion.*—It is well known that, when a collecting lens is used with the perforated mirror, for an

ophthalmoscope, and is moved in any direction at a distance of the focus most convenient to the observer, the position of all that is seen appears to be moved in the contrary direction to that in which the lens is moved. In the case of a cupped entrance of the optic nerve, the vessels as they pass through it (the most conspicuous objects) appear (if the depth is appreciable) to move more than those of the retina (which is supposed to be in focus) at the margin of the excavation, when the lens is moved, and most at the bottom of the cup where they are most remote and disappear in the substance of the optic nerve: so it was in the case I have related and from which my illustrations are drawn, the least movement of the lens seeming to thrust the vessels at the bottom of the cup forcibly in the opposite direction to the movement I had made.

These appearances may be demonstrated with a (small coffee) cup and a stick of liquorice, one end of which is stuck at the bottom of it, which, with a biconvex lens held before it, will be seen as it is affected at different parts of its length, the end next the observer being most distinct, least magnified and least altered in position apparently by the movements. In examining a patient's eye, however, with the lens, the parts are also apparently reversed in every way (not antero-posteriorly), but this addition of other refracting powers (the crystalline lens, etc.) does not alter the relation of the parts, so that with objects external to the eye and one lens the demonstration is good.

When the object (*retina*) is examined through the axis the most correct image is presented and when the ophthalmoscope lens only is moved, the same object is seen through the margin of the lens, which refracts more, and (always reversed) is therefore more and more bent as it is nearer the margin.* When some part of an object is more distant than another (*bottom and margin of the optic nerve excavation*) the former, if it is visible, is more affected thus apparently, and by different movements, the image may be turned in as many ways, and thus the vessels at the bottom of the cup appear differently placed in relation to other parts as in the

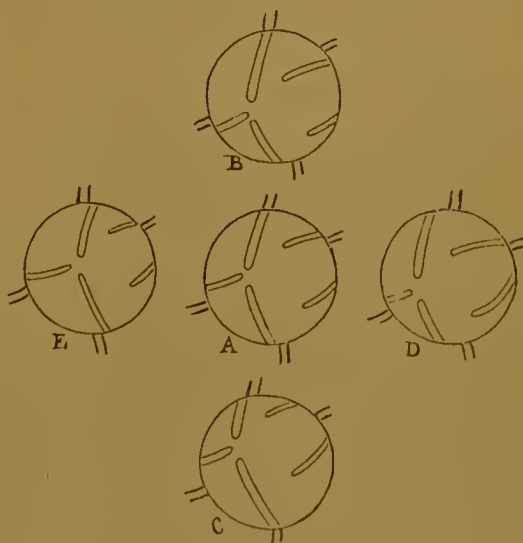
* Whilst centrally, by this movement, other parts are brought into view; so that, as the readiest way, this movement is ordinarily used in examining parts near to those in the axis of an ophthalmoscopic examination, although it is only to some slight extent available on account of the size and position of the pupil interrupting the light, so that the observer has to move his head also or change the direction of the patient's eye.

diagrams. (Plate XI, A, B, C, D, each of which shows the altered appearances of the veins in the cup when the lens was moved (A up, B down, C to the right, D to the left), as compared with the central figure in which the lens was held correctly in the axis of vision). The illusion is also increased by the nearer position of the pupillary margin which is seen when the object is viewed through it, and as one side of the cup is brought more into view and the opposite less by each movement of the lens, one or other side being thus hidden by its margin. This is to say, I believe, that spherical and other aberrations are greater for more distant parts as they are more magnified by the biconvex lens.

This exaggerated aberration of the vessels in the cup will show that an excavation exists, (that the vessels are not on a level with the retina is proved by their not being seen ophthalmoscopically when, *without the lens*, they are visible on the margin of the cup) and the greater amount of aberration in any case will by experience indicate the amount of excavation, which, if it was of importance, might be thus measured to a scale.

Sometimes I could have imagined that the vessels in the retina were the most remote; the cup was so deep, and its margin so projecting, that the vessels were hidden as they passed along the sides of the excavation, and seen in the cup, they appeared unconnected with those at its margin and in the retina; so that, without intervening parts for comparison, or perhaps in some other way, a *false* illusion could be produced: it then appearing that the vessels on the plane of the retina moved more than those at the bottom of the cup, and, passing from before, exposed them more in the cup on either side *towards* which the lens was moved.

In these cases no real doubt of the concavity of the optic nerve's entrance could be entertained: the last of this kind, I have seen, was an ordinary case of chronic glaucoma.



The *false* illusion,—A. lens held centrally, B. moved up, C. moved down, D. moved to the right, E. moved to the left.

Second—*of the pulse*.—In the present instance this pulsation (synehronous with that at the wrist) was sufficiently noticeeable in the main arterial trunk when the patient was admitted, but soon afterwards it could not be seen (without external pressure). The artery filled each time, and, becoming straighter, lessened the curves it made in bending over the margin of the exeavation: it appeared to stand forward (Plate XI, V, Y) and relapse in the intervals (Y in the eentral figure).

Third—*of the venous circulation*.—Slight pressure exerted on the globe with a finger increased the pulsation or produed it in the artery and very readily stopped the flow of blood in the veins of the eup (Plate XI, U), then making them empty so as to be hardly seen in it, unless their place was known. More pressure arrested also the arterial eirculation.

J. F. STREATFEILD.

PUBLISHED CASES.

CASE XXXV.—EXTRACTION OF A PORTION OF COAL WHICH HAD BEEN IN THE EYE TEN YEARS, WITH RECOVERY OF PERFECT SIGHT.

BY MR. NUNNELEY.

As the following ease illustrates a result which all who have seen much of ophthalmie surgery will admit to be rare, it seems to be not unworthy of being reeorded.

When a hard substance enters and remains in the eyeball, in spite of whatever may be done, in the great majority of eases, sooner or later, the organ is lost, for if it be not destroyed by aeute suppuration, commonly irritation is kept up after the more immediate aetive symptoms have diminished, and the ball becomes soft and ultimately shrinks and collapses, even though the foreign body be small and become embedded. This wasted condition not unfrequently oecurring after the lapse of some time.

In February last, J. A., a stout middle-aged man, a Collier by trade, applied to me. He stated that ten years ago, while blasting in the pit, the shot exploded too soon, scattering the fragments of coal with great violence, that by

some of these the left eye was struck, some entering the ball. That for six or seven weeks he suffered great pain, was nearly blind, and was unable to work, but that gradually the pain and inflammation ceased, and the sight of the eye became as good as it was before the accident; but that ever since there have been two or three black specks to be seen in the eye. He has continued uninterruptedly at his work until five weeks before his application to me, when the eye and side of the face were violently struck by the fall of a large hard substance, while at his work. The eyelids were bruised and swollen, but as he was not blasting nor using the pick, and saw the size of the piece which struck him, he is quite certain no particles entered the eye, and that it was simply a hard blow. However, since then he has suffered intense pain in and about the eye, great inflammation, and an inability to open the lids or to work.

I found every indication of acute irritative ophthalmia; there was intense photophobia and lachrymation; both conjunctiva and sclerotic were greatly injected; the iris was dull and inactive; the cornea, particularly at its lower half, was rough and hazy, where also was a dense opaque white patch, with two or three conjunctival vessels going to it, and behind this spot could be indistinctly seen, in the anterior chamber, a dark substance about the size of a swan shot, but what it might be, whether a clot of blood, dark fibrin, or a piece of coal, in consequence of the opacity of the cornea, it was impossible to say. Imbedded in the cornea, towards its upper and outer part, were two small portions of coal, and in the sclerotic conjunctiva near to them two or three very minute particles. As the man was quite certain no coal had entered the eye for ten years, and equally so that during this period until the receipt of the blow five weeks ago, the sight of the eye was perfect, and it was evident that the particles in the cornea were embedded in the tissue which was clear and healthy about them, the case was treated as one of traumatic inflammation. When I saw him after a few days he was very much relieved, the vascularity was lessened, the opacity of the cornea was much diminished, and as the dark spot in the anterior chamber had disappeared, I supposed it must have been a small coagulum which had been absorbed. I did not see him for a fortnight when I found the eye as much inflamed as it was when I first saw him. He said that it had continued to improve until the three previous days, since when he had suffered greatly. He now said that

he felt certain the coal in the eye was the cause of all the symptoms, and begged me to remove it. None was to be seen except the particles in the cornea, and though from the fact of the cornea about them being clear and healthy, I felt certain they were not causing any irritation, at his importunity I tried with a needle to extract them, but found, as I supposed, that they were deeply and completely embedded in the structure, with a layer of clear healthy firm cornea passing over them, while the lower part of this was soft, I therefore declined to farther meddle with them. Again in a few days he presented himself, saying he was certain there was a portion of coal deeper in the eye which moved about, as when the pain had violently returned he had seen it by looking in the glass. I declined to accede to his urgent request that I should open the eye and search for what I could not see, but directed him at once to come to me should he again see the portion. In two days afterwards he called, bringing with him his wife, both of them declared that before leaving home they had seen the piece, though none could be then seen. They were directed to wait in town for a few hours and should it again come into sight immediately to return. After a few hours they did so, when evidently a portion of coal occupied the same place in the anterior chamber in which I had seen the dark substance on the man's first visit. I at once sent him to the Eye Infirmary for operation, where I also saw it, but on his being placed upon the couch it had again disappeared. I now made him get on and off the couch quickly and shake the head suddenly several times, which brought the particle into view. A section of the cornea was instantly made when with the aqueous fluid escaped the portion of coal.

The next day the wound in the cornea had closed, its curve was restored, the inflammation and pain were much less, and the cornea was much less hazy. On the following day he was so much better that he returned into the country. In three weeks he went to work in the pit, the eye being perfectly well, and the sight as good as ever. The small portions in the upper part of the cornea remaining quiescent, as they probably will do, they having had nothing to do with the recent symptoms.

In this case, in all probability, the coal had been fixed in the posterior chamber, exciting while lying immoveable there no mischief after the subsidence of the first irritation, but that by the concussion of the blow, received five weeks before

I saw him, it had been detached and moveable, becoming at once a cause of irritation by floating through the pupil from one chamber into another when disturbed by the motions of the body or head, and, on entering the anterior chamber and resting upon the anterior surface of the iris, a source of mischief only to be allayed by its removal from the eye. The sudden and complete restoration of the eye after so long a residence of a hard substance within its interior, and the active disease caused by it during the last ten weeks, is an interesting fact.

CASE XXXVI. — ENTROPION, OCCASIONALLY FOLLOWING
(INVOLUNTARILY) A TRICK OF FORCIBLE WINKING.

BY MR. STREATFEILD.

Arthur Wire, aged 16, came to me at Moorfields on the 22nd of March, in the present year, complaining that his eyes were *watery*, and that sometimes he had to take hold of the eyelashes with his fingers to get them *right*. I found this meant that he had at such times inversion of the lower lids, and that he then, by seizing the ends of the long lashes, had learnt so to replace the lids in their normal position.

He was a sailor, and the occasional malposition seemed to have been produced by a way he had of closing the lids firmly for an instant, or, as he said, of *snapping* them, which he was in the habit of doing, probably to assist his vision for distant objects he was expected to see in his occupation. He had not generally any lachrymation or entropion.

As a cause of entropion, this would have little interest, but in connexion with the *voluntary* cases reported in the last number (X) of the Journal, at pp. 176 and 186. The patient, in the present instance, could not invert the lids at will, but he probably would have acquired the power by practising the plan he had adopted—the ciliary part of the orbicularis being exerted as in the two cases referred to, although for another purpose.

The palpebral apertures were small; the usual folds of skin above the upper lids extended over them to their margins, and the margins of the lower lids also showed large folds of skin so projecting as to be in contact with the lashes, and this must have been a chronic state of the parts, for

when one of the folds was drawn down with the finger, a furrow, which seemed to be lined with mucous membrane instead of skin, was exposed.

I excised from both of the lower lids a small strip of skin, close to the lashes, and a large portion of the subjacent ciliary division of the orbicularis muscle. The wounds cicatrized in a few days without any sutures, and the abnormal folds of skin were removed. It had succeeded in preventing any re-inversion of the lids, and until he returned to sea, and I lost sight of him, he had not found any difficulty of vision, although it is to be supposed he had not the power of compressing the eyes that he had had.

CASE XXXVII.—MUCH EDEMA, WITH SLIGHT CONJUNCTIVITIS, RECURRING ALTERNATELY IN THE TWO EYES.

BY MR. STREATFEILD.

Marian P., a housemaid, unmarried, aged 33, came to me first on January 19th, as an out-patient at Moorfields, complaining of a swelling of the lids of the left eye: this had been so for a week. She was very pale, and her pulse was weak and slow, but she did not appear to be otherwise out of health, nor had she any complaint of ill-health. The left eye only was affected: the lids were so edematous that she could only open them sufficiently to expose half the cornea, although the palpebral aperture, as seen in the right eye, was of fair size: the ocular conjunctiva was raised to some extent in the same way: the skin of the lids was pale and semi-transparent, not warmer or colder than usual: the swelling would take the impression of a finger indistinctly: there was no tenderness. With the chemosis there was slight redness of the conjunctiva, and some thin mucous discharge, but so very little that at first I did not observe it. With these indications, and having found no other, I gave her a mixture, combining quinine and iron, and a weak stimulating lotion for the eye, with which the edema and the conjunctivitis soon disappeared altogether.

On March 5th she came again, with all the symptoms in the right eye that she had had in the left, but in a somewhat less degree: the sub-entaneous and sub-conjunctival edema

was then on this side only, with some slight redness of small vessels of the conjunctiva, and mucous secretion. I now made more particular inquiries into her case. I found that at different times, for four or five years, she had been subject to "bloodshot" eyes, and for some time lately had been troubled with the swelling of the lids;* never, she said, of both eyes at the same time, or of the same eye twice in succession. She *always* had leucorrhœa:† menstruation had not commenced before the age of 21; it was then normal, and at these periods the swelling of the lids always disappeared, if it had been present. Two years ago she had several "blisters," the size of a fourpenny-piece, on the right leg, (the marks of some still remained—pemphigus?) her eye was then inflamed, she said, but there was no swelling. She said her general health was every way good, but that she was not very strong, perspired very much, and whenever she was at all out of health, the swelling of the lids, accompanying the conjunctivitis, was greater. When she first came to me, in January, it was because the lids were so swollen she could hardly see; before this time she had left off taking beer for some weeks because of her eyes. She had only been using warm and cold water to the eyes: the latter had seemed to benefit them. Her appetite and digestion were good. Her urine (1017) contained neither sugar nor albumen. She had not, and was not subject to, any swelling of the feet or of the face, but of the eyelids only. Except anemia, an ophthalmoscopic examination showed nothing noteworthy: her vision was good, and there was no intolerance of light. She said, that at first whichever eye was attacked magnified everything, and that all objects then looked clearer with it (extra blood supply?) The lashes were seldom agglutinated in the mornings; but, especially at the commencement of an attack, the eyes discharged a "watery matter." Yesterday, when the lids were beginning

* She had noted its recurrence for the last six months; and by the account she had kept it appeared that in September the right eye was affected, then the left, then again the right; in November the left eye, and in December the right (each time for two or three days only) was attacked; in January she came to the hospital. These occasions were much more transient and frequent, therefore, in the autumn, but the patient had not generally observed a greater liability to their recurrence at any particular season of the year.

† Some years before she had had to leave her place for giddiness and palpitations; she still had palpitation when making any extra exertion, such as running up stairs, and then she saw the objects move, with the beating in her eyes, for a minute or more.

to swell, she had headache, the eye was tender and felt "burning and heavy:" the swelling comes on rapidly and often disappears altogether in a single night. She had not observed that the swelling was greater at one time of day than another. During the six weeks since I had last seen the patient (in January) she had been in a new "place," and not able to come: both eyes, right and left in succession, had been attacked, and the lids swollen in this interval. I ordered the same mixture and lotion, some treatment for the leucorrhœa, and some simple dietetic rules, including the non-omission of the beer, to which she had been accustomed. After this time she attended regularly; I continued much the same treatment, and as she became stronger in health, each after-attack of conjunctivitis was less severe and attended with less and less edema.

On March 12th she came (the right eye had recovered on the 8th instant) with *both* eyes and eyelids in a healthy state. On the 26th, she came again with slight edema, etc., of the *left* eye, which had existed since the 23rd, the tenderness and irritability of the eye having been experienced on the day before. The watery discharge and all the symptoms were less in degree than on former occasions; for instance, the chemosis existed only in that part of the sub-conjunctival tissue which is not beneath the lids when partly open, and where their support is most wanting: the edema also of the upper lid was limited to its edge, or lower border.

During all the month of April the patient attended regularly for the medicine: she had iron, without the quinine: she had been living well, taking some beer with her dinner, etc.: she felt much stronger, her pulse was improved and she had some colour: the leucorrhœa, she said, was cured, and as the eyes had not been inflamed for so unusually long a time I do not expect to see her again at present.

Remarks—

I have not seen another case of edematous conjunctivitis like the preceding, in the alternation of its recurrence in the two eyes;* but a great amount of edema accompanying some slight conjunctivitis is not uncommon among very poor,

* With intervals of apparently complete recovery: in conjunctivitis, that is kept up for a length of time, the symptoms are often aggravated in one eye, the other being *comparatively* well.

weakly, anemie patients, and to an extent much greater than in the above-related case. Lately I have had two other such cases, both women, and neither of them old; but one was a pallid needlewoman and had been long suckling, and the other had the sallow complexion of a regular spirit drinker; the latter patient soon disappeared, but the former remained until she had benefited by the general treatment prescribed; she spoke of former recent attacks she had had of the same nature, and these were said to have been first of one eye and then of the other, and that at first both were so affected.

Conjunctivitis having once occurred, seems to be the more liable to return, and that it should not then choose the eye last inflamed, is perhaps a similar instance to the alternation of ophthalmia, etc. It is probable, also, that a predisposition to edema is acquired by its former occurrence; besides the infiltrated ocular sub-conjunctival areolar tissue, serous effusion would very probably next occupy the sub-cutaneous parts in chronic inflammation of the conjunctiva, for the same vessels supply the parts beneath the skin and the mucous membrane of the lids, and there is no areolar space immediately beneath the palpebral conjunctiva, similar to that occupied by the chemosis. In the case I have related, the low inflammatory action seems to have produced the edema from time to time; as it disappeared with the recurrent conjunctivitis, and therefore I did not treat it merely as a local weakness.* The conjunctivitis in this case produced an extraordinarily small amount of secretion from the mucous membrane, and the pemphigus and other symptoms seem to show a special tendency to serous effusions.

* I had thought of iodide of potassium and blisters; but with tonics, etc., the conjunctivitis and the edema were remedied, and the cause of the one which had produced the other was removed.

A FRAGMENT ON GLAUCOMA AND THE OPTIC PAPILLA.

BY DR. MACKENZIE (*of Glasgow*).

(*Received April 25th.*—ED.)

Former observations; new ophthalmoscopical facts; optical illusion in examining the papilla in the indirect method; normal state of the papilla; diseased states.

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I long since† established to my own satisfaction the three following conclusions regarding glaucoma:—

1st. That the sea-green appearance behind the pupil, whence the name arose, does not depend, as was once generally supposed, on any thickened or discoloured condition of the vitreous humour, but on a diplochromatic state of the crystalline, by which it absorbs the extreme prismatic rays, and reflects the middle ones.

2nd. That the vitreous fluid in glaucoma is superseded by an unhealthy secretion, which over-distends the eye, makes it feel hard, causes severe pain by pressing on the ciliary nerves, and obliterates the sensibility of the retina; a state of matters which I found to be susceptible of relief by paracentesis of the eye, through either the sclerotica or the cornea.

3rd. That in advanced cases, the optic nerve behind the eye shows itself, on dissection, in a state of atrophy, deprived more or less of its proper nervous substance, and flattened.

Ophthalmoscopic investigations have added some new facts to our knowledge of glaucoma. One of these is the pulsation of the arteries of the retina; and another, the

† See a paper "On Glaucoma," in Glasgow Medical Journal for August, 1830, and the different editions of my "Practical Treatise on the Diseases of the Eye."

coneave or exeavated state of the papilla of the optie nerve. Neither of these phenomena, however, is peeculiar to glaucoma; both of them being occasionally met with in other diseases of the eye. The former of them seems to indiate an increased resistence to the flow of blood in the vessels which supply the retina; the latter may be regarded as the effect of one or other, or of both, of two different causes, namely, the atrophied condition of the optie nerve, and the increased pressure on the internal parietes of the eyeball, from the superabundant secretion which occupies the place of the vitreous humour.

These phenomena can seareely be discerned in the advanceed stages of glaucoma, owing to the diplochromatic and muddy state of the crystalline. To see them, then, the student should be directed to examine a ease, in which the dioptric media have as yet lost but little of their normal colour and transparency.

To discern the pulsatory movement of the vessels, requires a sharp and experienced eye, and the observer will find it of service, while directing his attention to this point, to have the patient's head supported, and the diseased eye steadied by the fingers of an assistant.

If the indirect or inverted method of ophthalmoscopic observation be selceted, an optieal deception is apt to bewilder a beginner, as to the condition of the entrance of the optie nerve, a nearly eircular spot, though not unfrequently oval, variable in size, but measuring on an average 0.6 line in diameter, and which, although styled *papilla* or *colliculus*, is, in its normal state, nearly level with the retina, and even a little depressed in its centre. In the direct method, where the observer regards the illuminated non-inverted fundus oculi through an aperture in a coneave mirror, without the aid of any extraneous lens, the great magnifying power of the cornea and humours of the patient's eye, gives to the papilla an apparent magnitude larger even than that of the pupil; but in this way, it cannot be well seen as a whole, and generally requires the eye of the observer to be brought

inconveniently near to that of the patient. Instead, then, of using the patient's eye as a powerful single microscope, in actual contact with the objects on the fundus oculi to be examined, and thus viewing them directly, it is better to obtain a smaller but more defined image, although an inverted and virtual one, of those objects, by converting the patient's eye for the time into the object-glass of a compound microscope, which we do by holding in front of it a thick convex lens. The image which we then see of the several parts of the fundus oculi is an inverted one, like that of an object examined with any ordinary compound microscope; the entrance of the optic nerve is seen towards the temple instead of the nose; the macula lutea appears to the nasal side of the optic nerve instead of the temporal, and a little below the level of the nerve instead of above it; while the principal trunks of the retinal vessels, instead of branching in the direction of the temple to embrace the macula lutea, seem to bend towards the nasal side of the eye. The apparent position, in fact, of all the objects on the fundus, viewed in this way, is the reverse of their real position.

The most important optical deception which arises from viewing the fundus in the indirect method, as well as the most puzzling to a beginner, affects the papilla. The student has probably heard, that the papilla, in the glaucomatous eye, is cupped or excavated, but to his view it appears quite the reverse, it appears rounded and prominent.

To comprehend clearly that this is an illusion, all that one requires to do, is to impress with the head of a pin, a small dimple on a bit of paper, and put this under a compound microscope, with the concave side of the impression uppermost. The same appearance will then be seen, which is presented by the papilla of the glaucomatous eye, namely, that of a rounded and protuberant surface.

This optical deception arises from the inversion which the image suffers by being viewed through the compound microscope. We judge that an object, viewed with a single eye, is convex or concave, solely by the manner in which

light is reflected from the body under examination. The light which falls obliquely on a convex surface illuminates that side which is nearer to the source of light; the side farther from it is in shade. The light which falls obliquely on a concave surface illuminates that side which is farther from the source of light; the side nearer it is in shade. Let the source of light remain in the same position, but invert the image of the object illuminated, so that the light which falls on the farther side of it may seem to fall on the near side, which is the case when we look through the compound microscope at the hollow on a bit of paper, or when we examine the optic papilla through the compound microscope formed for the occasion by the patient's eye *plus* the convex lens held in front of it; and both the dimple on the paper and the papilla, although they are actually cupped or concave, will then appear convex and prominent.

If, on the other hand, we turn the convex side of the dimple on the paper uppermost, and view it with the compound microscope, it appears concave. The inversion of its image causes the light which falls on its near side to appear as if it fell on its farther side, and thus the eye is subjected to a deception the reverse of the former, and from which it cannot free itself. If there be cases, then, in which the end of the optic nerve within the eye actually projects in a convex form, they will offer, when examined in the indirect method, the appearance of a cup or depression.

Such facts have long been familiarly known; the apparent transmutation of an intaglio into a cameo, or that of a cameo into an intaglio, under the compound microscope, being a common source of amusement, fully discussed by Sir David Brewster in his "Letters on Natural Magic, Letter V." Important as their bearing is on pathological examinations of the eye, they seem to have escaped the notice of ophthalmoscopists, till attention was directed to the subject by Dr. A. Weber, in a paper in the "Archiv für Ophthalmologie," Band II, Abtheilung I, Seite 141.

In a highly interesting communication in the same

journal (Band IV, Abtheilung II, Seite 1), Dr. H. Müller has directed attention to the normal, as well as to several diseased states, of the optic papilla.

His account of the entrance of the optic nerve into the eye, and the diagram which he gives in illustration, tally remarkably with the thirteenth figure in Mr. Bowman's "Lectures," and the corresponding explanation. From the statement and figures of these two observers, especially those of Dr. Müller, it may be gathered that the lamina cribrosa is normally somewhat concave towards the interior of the eye; that the fibres of the optic nerve, suddenly losing their white substance and dark outline, enter the eye on a level with the chorio-capillaris; that at this point the whole nerve, from the change which its fibres have just undergone, is considerably and rather suddenly reduced in thickness; that the fibres, bending more or less abruptly outwards, and spreading around, become clothed by the exterior or radially disposed layers of the retina; that the edge of the opening through which the nerve passes into the eye, as well as the fibres themselves as they traverse that edge, form a slight elevation or approach to a papilla, leaving in the situation where the trunks of the central vessels of the retina generally make their appearance, a small foveola.

Dr. Müller points out the difficulties which attend the anatomical examination of this depression, arising from the softness of the part, and its liability to change on being touched; and shows how these difficulties may best be obviated. He directs attention to the varieties which exist in different individuals; varieties in the depth of the depression, from 0·2 to 0·5 millimetre; varieties in its form and position, for it is not always symmetrical, and does not always correspond to the middle of the nerve, but is sometimes considerably nearer to the macula lutea, or has one portion of its edge more raised than the rest; varieties in the disposition of the vessels, for while the large trunks generally emerge from the middle of the foveola, one or more sometimes seek a passage for themselves close to the edge of

the chorio-capillaris, so as to make their appearance by the side of the nerve; facts, all of which should be carefully borne in mind by ophthalmoscopists.

In regard to abnormal prominence of the papilla, Dr. Müller shows, that this is likely to arise from an atrophied state of the exterior layers of the retina, a thickened condition of the primitive nervous fibres, as well as infiltration of the nerve by blood, inflammatory exudation, or new formations. He relates a case in which a concretion in the site of the lamina cribrosa caused a protuberance of the papilla. The very earliest stage of encephaloid tumour should show an abnormal prominence of the papilla.

On the other hand, intra-ocular pressure, and atrophy of the nerve, existing either singly or in combination, are the causes of abnormal excavation of the papilla. In cases of intra-ocular pressure, either simple, or combined with atrophy of the nerve, paracentesis, either corneal or sclerotal, is likely to produce a change in the depth of the excavation, sufficient to be recognized on ophthalmoscopical examination.

Morbid excavation of the papilla varies in depth, reaching in extreme cases to a millimetre beyond the level of the choroid. In such cases, the sides of the excavation are nearly perpendicular, or are even concave, and its edge, of course, impendent, so as partially, or even completely, to hide from view the course of the vessels as they pass from the bottom of the excavation and over its edge to the retina. In slight cases, the sides of the excavation are convex, and its form that of a funnel. The lamina cribrosa, under such circumstances, keeps its place, but in more advanced stages, it is pushed back, and the excavation is much extended laterally. Such extreme cases of expansion are not the result of uncombined atrophy of the nerve, but must arise from the supporting resistance of the parts being weakened by previous inflammation, whence they come to yield more readily to intra-ocular pressure.

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ON THE DIFFERENT FORMS OF INFLAMMATION OF THE EYE CONSEQUENT ON INHERITED SYPHILIS.

(*Concluded.*)

BY MR. JONATHAN HUTCHINSON.

(*Received April 24th.—ED.*)

INFLAMMATORY OPACITIES IN THE VITREOUS BODY, LENS, ETC.

That in the form of inflammation of the eyeball which results from acquired syphilis the choroid is not unfrequently affected, has been placed beyond all doubt by the introduction of the ophthalmoscope. White patches of lymph may, by its aid, frequently be seen occupying various positions in the fundus of the eye, and their removal may often be effected by mercurial treatment. That these deposits are in the choroid coat is proved by the fact that the retinal vessels may usually be seen upon their surfaces. The inflammation however by no means confines itself to the choroid. A condition of general cloudiness is sometimes observed, which can be explained by no other hypothesis than that the delicate framework of the vitreous itself is the seat of inflammatory deposit. In fact, syphilitic ophthalmitis, although most frequently met with as a form of sclero-iritis, may involve any one or all of the different structures of the eyeball.* This, then, being the state of things in the acquired syphilis of adults, we might conjecture that nearly the same would be observed in the inherited disease of children;—and such is indeed the fact. Were it not that in them the choroiditis most often occurs, either with or

* To Dr. Jacob, of Dublin, much credit is due for the strenuous assertion of this doctrine many years ago.

after an attack of keratitis, I have no doubt that it would be much more frequently noticed. It is the hazy state of cornea which not seldom prevents an ophthalmoscopic inspection and also furnishes an apparent explanation of the impairment of vision. Every now and then, however, we meet with examples of choroidal disease of this type, in which either the corneæ have escaped or have cleared sufficiently to allow of examination. In such the disease may be traced through several distinct stages. The first of these is characterized by much dimness of vision, and by the presence of diffused patches of lymph, the retina being hazy and not unfrequently the vitreous also. After a while the sight improves and the patches are more defined, and in the third stage, that of cure, they are seen abruptly circumscribed and unattended by any general swelling of the adjacent tissue. The cases to follow exemplify chiefly the two latter stages of the disease. Although, as I shall have to show subsequently, the changes chiefly involve the choroid, yet I have no idea that they are always limited to it. Even if they were, it could scarcely be expected but that the overlying retina should also suffer in some degree. The degree of vision, which the subjects of most extensive choroidal disorganisation of this kind often retain, is however proof that the retina is but slightly and secondarily involved. (See Case III., Charles M.)

It must not be supposed that this form of disease is invariably of one type, for although in most instances such is the case, in a few remarkable deviations occur. The first case which I shall adduce is one in which the effusion was unusually extensive.

Case I.—Hereditary syphilis—Free effusion of lymph into the choroids of both eyes.

Frederic C. B., aged 17 months, was admitted in December, 1857. His mother stated that she had suffered from sores, followed by a rash, soon after marriage. Of her first

three infants, two had been born dead, and one had died soon after birth; the patient was her fourth, and the only one now living. At the age of three weeks he had "dreadful snuffles" and discharge from the nose, and although at first a fine baby, rapidly fell away to a miserably puny one. When three months old a rash broke out, and the mouth and nates became very sore. He was now treated by a physician for inherited syphilis, and had mereury freely given, with the result that all external symptoms passed away. When his mother brought him to the Ophthalmic Hospital, it was on account of her fear that he was going blind. She had noticed that his eyes rolled about much, and had fancied she saw "a white skin" on the left. The child now had a clear skin, but there were puckered scars at the angles of the mouth; his teeth were small, of bad colour, and very irregular, and the bridge of the nose was sunken. Even without the use of the ophthalmoscope, it was easy to see that a yellow white substance occupied the fundus of the left eye. Both irides were perfectly clear, and there was no sclerotic congestion. Light was borne well, and both pupils were fairly active. Atropine having been used, it was seen with the ophthalmoscope that an extensive layer of lymph was smoothly spread out over almost the whole of the central part of the choroid, comprising as much as could be brought into view at once. No vessels were seen on its surface, and the presumption, therefore, was that either it was upon the retina, or, more probably, that it had led to its destruction. Its smooth surface opposed the idea that it had been effused free into the cavity of the globe. In the right eye numerous white spots of lymph were seen, but the retina itself was not disorganised, and the entrance of the optic nerve was distinct and normal. The infant, as far as could be ascertained, was all but sightless. The iodide of potassium internally, and mercurial inunction were prescribed; but, owing to the mother's irregularity of attendance, the treatment was very imperfectly carried out.

On June 18th, six months after admission, the note states

that "he can see with the right better than he did, but only very imperfectly. In it the spots remain in *statu quo*, and are still plainly visible. In the left the large patch of lymph is more easily seen than it was, because it has become much whiter and more glistening. As to prominence and extent it is much as it was."

Case II.—Large cicatrices in the choroid of the left eye—Teeth and physiognomy typical of hereditary syphilis.

For permission to make use of this case, I am indebted to Mr. Dixon, under whose care the boy was. Charles H., aged 14, from Croydon. The lad was brought to the hospital on account of very defective sight in the right eye. His left eye had almost perfect sight, and he could read easily. On examination with the ophthalmoscope, numerous patches of various shades, from red and pink to white, were seen beneath the retina. One of these which was nearly circular, very much resembled the optic entrance, and excepting for the absence of vessels, might easily have been mistaken for it. By the margins of the white patches, were many small masses of pigment. The right eye diverged considerably, and he could see but very little with it. His mother stated that he was her only child, and that in infancy he had suffered severely with rash, thrush, snuffles and sores at the anus. These symptoms the medical man who attended him had said, were "due to disease derived from his father." His mother had had one miscarriage prior to his birth, but had never since conceived, although now for six years married to a second husband. The boy's aspect and teeth were most characteristic. He was of bad complexion, and had psoriasis on the face. The affection of the right eye was believed to date almost from infancy. As the choroidal changes were evidently those of long passed and now retrograde disease, Mr. Dixon did not adopt any treatment.

Case III.—Extensive cicatrices in the choroids of both eyes — Physiognomy and teeth suspicious — History suspicious.

Charles M., aged 20, a pale cachectic lad came under my care, with a written memorandum by Dr. Bader, who had previously seen him, "specific changes in both eyes; of six years' duration." The ophthalmoscope showed abruptly circumscribed patches, of a dead white colour, on various parts in the fundus of each eye. In both, the retinae, where not involved by the patches, were very pale, and the optic entrances were irregular. The patient notwithstanding these changes, stated that he was still able to work as a shoe maker, though he could see but very imperfectly. His physiognomy was very suspicious, and his teeth, although by no means typical, were small and much worn down. There were fissures extending from the angles of the mouth. His father was dead, and was reported to have been a dissipated man, although as far as his mother knew, neither had he or she ever suffered from venereal disease. His mother had borne sixteen children, of whom he was the only one now living. An elder brother, who had died at the age of seventeen, had attended this hospital with "bad eyes," for many months.

Case IV.—Hereditary syphilis—Interstitial keratitis, with cataract, choroiditis and iritis — Complete loss of vision in one eye—Excision of the globe and subsequent examination.

Mary Ann R., single, aged 21, under the care of Mr. Poland, during 1859 and 1860. Her aspect was most characteristic of hereditary syphilis. Her teeth, both upper and lower sets, were horizontally notched and most extensively deformed, but the upper incisors (the test teeth), had been so much broken away by caries, that their vertical notches were scarcely recognizable. Her right globe had been excised by Mr. Poland, having been disorga-

nized and rendered sightless, by the results of syphilitic choroiditis, etc. It appeared from her history that she had had a cataract in this eye. At another hospital four operations had, she said, been performed for the removal of the cataract. (See Dr. Bader's Report below.) Her left cornea had opacities in its structure, and the pupil was adherent at two or three points. She could just manage to see to read, but only with difficulty. It appeared that she had had excellent sight, up to the age of 17, when an attack of inflammation occurred, in which both eyes were involved, and which rendered her blind for some weeks. She was the eldest living in her family. The first infant had died at three days' old. Two younger than herself, and aged respectively, 20 and 17, were living, and reported to have good eyesight.

The following account of the ophthalmoscopic examination and of the dissection of the globe after excision in this case, has been obligingly supplied to me by Dr. Bader. I am not aware that any other opportunity of examining after removal the exact state of the choroid, retina, etc., in this form of disease has been obtained. The report is, therefore, peculiarly valuable.

Report of the state of the eyes at the date of the excision.

LEFT EYE.—Portions of the cornea are slightly misty; its convexity is increased; the anterior chamber is large, the iris has the peculiar steel-blue colour; several posterior synechiæ exist but interfere only slightly with the activity of the pupil. With the ophthalmoscope the optic nerve is seen to be of a gray-pink colour, as is frequently observed in similar cases; the coats of the fundus are thinned, and staphylomatous near the optic nerve.

Portions of the choroid are sprinkled with minute black dots.

The sight of this eye, considering the state of the cornea,

pupil and fundus, is good. The eye is irritable from sympathy with its fellow.

The RIGHT EYE had no perception of light.

The iris could only be seen here and there, owing to the extensive opacity of the cornea, and, where seen, was in apposition with the latter. The greater part of the cornea was replaced by opaque tissue, portions of which were staphylomatous.

The tension of the eye was normal. It had occasionally been painful and red since vision was lost; and during the last month there had been constant pain and inflammation. The eye was excised by Mr. Poland and was immediately examined.

It was generally enlarged, but the transverse diameter exceeded the anterior one.

The anterior surface of the rotten and atrophied iris was adherent to the tissue which replaced the cornea, and was in apposition with the translucent portions of the cornea. The opaque thickened suspensory ligament was adherent to the posterior surface of the iris; the thickened, empty lens capsule adhered to the pupillary margin and to the tissue which replaced the cornea.

The vitreous space was occupied by a chocolate coloured turbid fluid, which consisted of debris of the framework of the vitreous humour, of blood-corpuscles and of a highly albuminous fluid.

The inner (vitreous) surface of the membrane, which intervenes between that part of the choroid known as the ora serrata and the vitreous space, was sprinkled with smaller and larger gray opaque patches of fibrous tissue. The choroid surrounding those patches and the neighbouring ciliary processes were edematous.

The retina was in apposition with the choroid, it was slightly hazy, but admitted of a good view of the choroid. Minute grayish-white and yellowish opaque dots were seen in its substance, especially round the optic nerve. The optic nerve itself and the yellow spot appeared healthy.

The choroid appeared much thinned, and was of a pale brown colour. Its retinal surface was sprinkled with minute, black, roundish spots; these were most numerous on the portion situated between the equator of the eye and the ora serrata. Some of these spots projected from the choroid, but without affecting the surface of the retina. Portions of the latter remained adherent to the choroid when peeled off; this occurred chiefly to those portions of retina which were situated over or near the black spots.

Microscopic examination of the diseased Tissues.

a.—The choroid and the hexagonal cells.

The stellate pigment of the choroid and the large choroidal vessels offered no peculiarities.

Numerous clusters of cells were deposited round the capillaries and round those of the larger choroidal vessels, which are near the elastic lamina; these clusters had a roundish shape. The cells were of crown-glass colour and strongly translucent, being in size somewhat larger than blood corpuscles. Some of the blood vessels were entirely surrounded by cells, others only on the side nearest the elastic lamina. The latter had in many places disappeared, and the cells had passed through the gaps and occupied the place of the adjoining rods; these latter were in other places distorted, bent, etc., by similar clusters of cells.

In no instance had these cells passed beyond that part of the retinal framework.

The cells were in immediate apposition with each other, and separated from the surrounding parts by a thin layer of obscurely fibrillated tissue; the fibrillæ are lost sight of in the surrounding pigment of the choroid; in the retina they mingled with the rods.

The margins of the apertures in the elastic lamina of the choroid were thickened by a tissue similar in appearance and transparency to that of the lamina.

The hexagonal cells appeared normal, except those over portions of choroid which were occupied by clustered cells, and except those which immediately surrounded the apertures in the elastic lamina.

The former had lost their hexagonal shape; they were rounded off, and their pigment granules, instead of being of a pale brown colour as the remainder, appeared, some deep brown, others black; which, seen with the naked eye, gave the choroid the appearance of being sprinkled with black dots. The latter were heaped up round the apertures in the elastic lamina; they were round, and their pigment granules were black; at many places these cells had been displaced among the rods.

The clusters of cells were most numerous in the portion of choroid at the equator of the eye; the choroid round the optic nerve and yellow spot appeared healthy.

b.—The retina.

The framework of the retina, the rods excepted, appeared not changed, the latter were, as above mentioned, displaced, distorted, etc., by the morbid products emanating from the choroid. Many of the loculi, formed by what are called the radial fibres, were empty, others were occupied by healthy looking cells, others were filled with what appeared to be oil globules.

The greyish white and yellowish opaque dots, seen in the retina with the naked eye, were due to these accumulations of oil (?) globules in the loculi of the retinal framework.

The place of the delicate cell-layer, immediately beneath the optic nerve fibres, was occupied by an amorphous molecular greyish deposit.

The walls of the retinal blood vessels were thickened.

The layer of true optic nerve fibres which overlays the retina appeared healthy.

Case V.—Entire loss of vision in both eyes in a boy, the undoubted subject of hereditary syphilis—Ophthalmoscopic examination wanting.

Edward W., aged 10, of fairly healthy aspect, but pale. Bridge of nose rather broad, and some psoriasis about the skin of face. The incisor teeth were not notched, but of very peculiar form, being so much narrowed laterally, that they almost resembled canines. Their form was such that, despite the boy's healthy aspect, and the absence of notches, I at once suspected the true nature of the case.

The history was, that in infancy he had had purulent ophthalmia, after recovery from which, however, he enjoyed perfect sight, and retained it until a year ago. The left eye began to fail first, and subsequently the other; and after a few months he became, as he was when these notes were taken, totally blind. On inspection, the left pupil was seen to be much larger than the other, and both were very sluggish. There was not the least congestion about any part. His tonsils showed cicatrices, and were atrophied. His mother stated that she had had syphilis soon after her marriage, and had suffered severely from it.

I have unfortunately mislaid my notes of the ophthalmoscopic examination in this interesting case, and, not knowing the boy's address, am unable to complete the account. It may be conjectured that both eyes were in the condition illustrated by the left in Case I.

Case VI.—Numerous cicatrices in the choroid—Syphilitic physiognomy and teeth—History of infantile symptoms.

Charles D., aged 9, the second of three living children (a fourth having died), attended under Mr. Bowman's care during 1859. His mother denied all history of syphilis, but she did not appear to speak openly, and against her denial were the following facts. In infancy he had

suffered from bad and prolonged snuffles, attended with a rash in the body, for the cure of which the late Mr. Gossett ordered a small pill night and morning for many months (probably mercury). His mother stated that he took the pills almost continuously for nearly two years. His aspect was characteristic; nose very much sunken indeed: head large: teeth separate, narrowed, and slightly notched (quite typical).

In both eyes the ophthalmoscope showed numerous round patches in different tracts of the retina, of various sizes, quite white and glistening. Around many of them was seen a minute crescent of iron-black pigment. The patches were totally destitute of vessels. The retina on other parts was paler than normal, and as if thinned. In many large, ill-defined patches, slender networks of vessels, were seen coursing over surfaces destitute of pigment, and looking as if on paper. In each eye the cornea, lens, and vitreous body were perfectly transparent, and allowed of the deeper structures being very clearly seen.

The boy had great difficulty in directing his eyes, and there was a slight squint, but he could see sufficiently to have learnt his letters. He always looked sideways at anything he wished to see—never straight.

The history of his eyes was that in infancy he always had a peculiar rolling motion of the globes, and did not appear to see well. On account of this symptom many surgeons were consulted. No external inflammation of the eyes ever occurred. It thus appeared probable that the choroiditis dated back from early infancy, about the age when iritis usually occurs. Very possibly the boy may, in the sequel, suffer from keratitis.

Case VII.—History of hereditary syphilis—Numerous cicatrices in the choroid of the right eye.

Samuel B., aged about 12, of fair complexion, and characteristic aspect. His four upper front teeth were all

out; the canines and lower set presented as marked features as are ever seen in those teeth, being remarkably peg-shaped and notched. His mother had borne six children, of whom three had died, Samuel B. being the second of those living. When an infant, he attended the hospital on account of inflamed eyes; the attack, according to his mother's description, not having been one of purulent ophthalmia. He had at that time bad snuffles and a troublesome rash on the body, as well as a very sore mouth. His mother stated that she had contracted syphilis from her husband subsequent to the birth of her second child; and that, although treated by mercury, she had suffered afterwards from ulcerated sore throat and rash. All her children born since had had specific symptoms in infancy, excepting the last. The sight of the boy's right eye was all but lost. The ophthalmoscope showed many circular white patches, not a few of which had black dots in their centres. The patches were of glistening white and the choroid and retina appeared to be wholly disorganised and absorbed at these parts. My note, as to their condition, was taken July 8, 1859, unfortunately it is very incomplete, and I have no mention of the state of the other eye.

Case VIII.—Hereditary syphilis in a severe form—Keratitis in both eyes at the age of two years—Entire loss of sight in the left from choroidal disease at the age of twenty.

Emily H——, aged 23, bearing the physiognomy of hereditary syphilis most unmistakeably, came under my care in January, 1859. She had often been a patient at the hospital previously—indeed, almost the whole of her life. The bridge of her nose was sunken and broad, there were large cicatrices at the angles of the mouth, and many pits in the skin of the face and forehead, the skin itself being thick, oily, and of bad tint. Her teeth were small, peggy, of bad colour, and the upper incisors notched. Her tonsils were wasted, and she was somewhat hoarse. Her mother told me that she

was separated from her husband on account of his having several times given her venereal diseases, from which he had himself suffered very severely. Emily H. was the only one now living, and the eldest born. Two born subsequently had died (the first of hydrocephalus, under the care of Dr. Conquest; the second "of consumption," much wasted, at the age of nine months). In infancy she had purulent ophthalmia, and bad snuffles, a rash over the body, and a very sore mouth. She was treated for hereditary syphilis; and subsequently, when two years old, she was for three months under Mr. Scott's care at the Ophthalmic Hospital, for what, from the history would appear to have been keratitis. She recovered so far from this as to be able to learn to read, but her sight was ever afterwards much impaired. About eighteen months ago her left eye began to get rapidly worse. She had severe, long-continued, and deep-seated pain in the globe, and after the lapse of a few weeks was so blind that she could but just perceive the window. At the date of my note she could not detect the shadow of a hand passing before the eye. The cornea was bulged and hazy: the pupil dilated and fixed. She had been accustomed to see black museæ floating before it, whilst she retained sufficient power of vision to perceive them.

Case IX.—Strabismus, Cataract and partially adherent pupil after an attack of Kerato-Iritis—Typical teeth.

Elizabeth G., aged 20, the youngest but one of a family of five. This patient was admitted on June 30th. With her right eye she could see to distinguish large objects, and could even read large print. Its iris was of steel-grey tint, concave and partially adherent at its pupillary margin, but fairly mobile. There was a semi-lunar portion of opaque membrane visible just within the area of the pupil in its lowest part. Her left eye was slightly divergent and prominent. Its pupil was wholly excluded by adhesions

and immobile, its area being occupied by greyish white glistening material, evidently the remains of disorganized lens.

The history given was, that she had enjoyed perfect sight up to the age of nine years, when during an acute attack of inflammation (keratitis?) she was blind for six months. This slowly passed off and left her sight much impaired. Her corneæ had now so far cleared that only a few interstitial films were visible. Her teeth, both upper and lower sets, were narrow, peg-shaped, and quite typical of hereditary syphilis. I had no opportunity of obtaining any history of her infancy, but my notes state that both Mr. Dixon and Dr. Bader fully agreed with me in considering that the diagnosis of hereditary syphilis was established.

Case X.—Cataract, with disease of the vitreous body and deposits in the retina —Physiognomy and teeth typical as regards hereditary syphilis.

Caroline G., aged 13, was admitted as an out-patient on October 14th, 1858. I saw her for the first time on March 10th, 1859. Her hospital letter had the following note on it, written by Dr. Bader, at the date of her first admission: "Vision failing for a year past. In the right eye numerous black patches on the retina and some around the entrance of the optic nerve. Some opacity of the lens. Cataract in the left eye." Fully recognising her diathesis, Dr. Bader had prescribed the bichloride of Mereury, in doses of one-twentieth of a grain three times a day.

On March 10th, 1859, her condition was much as when first described by Dr. Bader. There was a well-formed homogeneous, bluish cataract in the left eye, which according to her statement, had been present for several years. She was quite positive that it had formed within her recollection, and had not existed in infancy. The sight of the right eye was so defective that she could not see to read; she

expressed herself as quite certain that three years ago she could read easily. On ophthalmoscopic inspection of the right eye, black striæ were seen in the lens and in the vitreous humour. On the retina were many black spots of deposit.

This girl's teeth and physiognomy were most typical. Her face was covered with patches of psoriasis, and presented small pits. She had had small pox when nine years old.

Case XI.—Hereditary syphilis—Supervention of a cataract in the eye at three years of age—Iritic adhesions—Full history of syphilis, treated by mercury in the parents.

Sarah Ann C., aged 3.—This child was brought for the first time on September, 3rd, 1858. In her right eye was a well-formed blueish-white cataract. The pupil was fairly mobile. The other eye appeared perfectly healthy, and there was not the slightest congestion in either. Although well-grown and stout, the sunken bridge of her nose and some fissures at the angles of the mouth, at once attracted my attention. There was also a patch of psoriasis on one cheek, and all her central upper teeth were affected by that peculiar form of black caries, which I had previously noticed in one or two syphilitic cases. The lower teeth were, with one or two slight exceptions, free from caries. Her mother who brought her, was a woman of pale earthy complexion. On enquiry, I ascertained respecting the child, that in infancy she had suffered long and severely from snuffles, had had a very sore mouth, and sores at the anus, which lasted a long time, with also an eruption on the body. Her eyesight had been good in both eyes, until within a few months. She had several times had gumboils, and once her tongue had been very sore.

The mother told me that her husband was dead, that this was her only child, and that she had miscarried twice since its birth. Her own health, she said, had never been

good since marriage, and on my asking the direct question, she at once confessed to having had venereal disease from her husband prior to her confinement. The medical man who treated her, gave mercury to salivation, and subsequently a copious eruption appeared. The disease was contracted only about two months before her confinement. The infant was not subjected to any special treatment, and beyond the symptoms above mentioned, was not considered ailing. It was at the breast the whole time that her mother took the mercurial course. The mother still suffers from periosteal pains in the head, etc.

Atropine dilated the pupil very imperfectly, and it was then apparent that there were rather extensive adhesions of the inner border of the iris. Spots of uvea were seen on the surface of the lens, and in its structure were several masses of yellow chalk.

Case XII.—Cataract with iritic adhesions in the left eye of a girl known to be the subject of inherited syphilis.

Miss H., aged 14, came under notice in consequence of her elder brother being under my care for well-marked interstitial keratitis. Her father had lost one eye by syphilitic iritis before his marriage, and his eldest son had suffered severely from infantile symptoms, and presented the various indications of the diathesis;—notched teeth, etc., in a very well-characterized form. I requested to see his younger sister and she was brought at the next visit. She was three years younger than her brother, and the account was that in infancy she was fairly healthy. Her teeth showed horizontal notches, but no vertical ones, and there was little or nothing in her physiognomy to have excited suspicion. She could see but very little with her left eye. On inspection I found the lens in a condition of bluish-white haze. It was not densely opaque in any part, but sufficiently so to prevent the transmission of light. The pupil was fairly mobile, but there

were numerous small tags of adhesion between it and the capsule of the lens; the other eye was quite unaffected. I did not obtain any clear history of the attack of inflammation during which the changes described had taken place, but her mother said that in early childhood she was quite sure that both eyes had perfect sight. She believes that the changes in the left had occurred within the last few years.

Case XIII.—Extensive inflammatory changes in both choroids—Aspect and teeth of hereditary syphilis.

In April, 1860, Dr. Bader brought under my notice the following case, which he considered to be an instance of choroidal disease dependant upon hereditary syphilis. William N., aged 13, a boy of very dark complexion, and of markedly syphilitic physiognomy. His mother stated that he was her only living child, but she was herself so deaf that it was impossible to obtain any history of his infancy. His eyesight had been failing for many years, but he had never had any attack of external inflammation; his corneæ were both perfectly clear; his upper incisor teeth were characteristically notched; his vision was so far impaired that he could only read large print with great difficulty; his left eye was the worse of the two, and both were somewhat improved by the use of concave glasses. On ophthalmoscopic examination the optic entrances in both eyes were seen to be ill-defined; the vessels of the retina were small, and in the choroids were numerous small white patches, interspersed with deposits of pigment; the choroidal patches were not abruptly defined, but merged off gradually into the more healthy structure; the morbid conditions were most advanced in the left eye.

Case XIV.—Physiognomy of hereditary syphilis characteristically marked—History of a bygone attack of double interstitial keratitis—Choroidal changes in both eyes.

The notes of the following case are from those kindly

supplied to me by Dr. Bader. In it the choroidal changes were well marked. It is from the left eye of this patient that the drawing was taken. See plate X., fig. V.

Emily D., aged 18. She was a delicate girl up to the age of ten years; she has suffered much from headaches; at the age of 16 she had an attack of rheumatic fever. It was stated that her sight began to fail twelve years ago, and that seven years ago both eyes were inflamed, but as far as can be ascertained, by the patient's account, without implication of the retina. There was then, it was stated, merely the power of perceiving light, and this continued for some months, after which the inflammation subsided, and the sight gradually improved, the eyes being left in the condition described below. August, 1859, the patient bears the typical marks of hereditary syphilis; the teeth are stumpy, the corneæ hazy, the tonsils swollen, and the general aspect clearly indicative of the diathesis. It may be remarked that her sister presents similar characteristics. The corneæ of both eyes are slightly hazy and irregularly oval; the pupils are active but irregular; the irides have the characteristic steel-blue colour; with the *right* eye she can read the smallest type, and can tell the time on a distant clock; with the *left*, which was always the weaker and smaller, she can see, but cannot read, large type—she can see the face of the clock but cannot tell the time. It appears, by this examination, that she can see better with some of the lateral portions of the retina. In both eyes, with the ophthalmoscope, the lens and the vitreous humour are transparent. When the examination is not assisted by the lens numerous black museæ appear to be floating in the vitreous space (this appearance is due to the oscillation of the eye bringing to view different pigment patches on the fundus). The optic nerves are small and slightly oval, greyish pink, hazy, indistinct, not well defined, and shade off into a whitish ring which separates the rest of the optic nerve entrance from the fundus. Passing through the left, a few retinal vessels only are dimly seen, but in the right they are more numerous.

The fundus round the optic nerve and at the yellow spot is hazy, red, and is sprinkled with irregular white and brown patches, and with minute pigment granules. On the lateral parts the large choroidal vessels are well seen, and here also the fundus is sprinkled with numerous large well-defined black patches.

GENERAL COMMENTS.

In addition to the above fourteen cases I might quote several others, in which, in conjunction with keratitis, the choroid was undoubtedly affected. I omit these, however, because the opacities in the cornea were such as to prevent any satisfactory examination of the state of the deep structures. In the cases which I have adduced we have examples of choroiditis in ten; of deposit in the retina in two (Cases I and X); of inflammatory opacity of the vitreous body in one (Case X), and of opacity of the lens in five (Cases IV, IX, X, XI, XII). The patients varied in age from seventeen months to twenty years, and it would appear probable that the period of life most liable to attacks of heredito-syphilitic choroiditis, and its cognate affections, is the same as that in which interstitial keratitis is most frequent (See page 94). In six instances out of the ten in which the notes advert to this point, the patient was the eldest living in the family. Iritic adhesions were present in four or five of the cases. The patients were all members of different families and represented an aggregate of twenty-one living individuals out of forty births, giving an average to each family of five births and only two living. In these features the group corresponds with what was proved to be the fact as regards the subjects of interstitial keratitis.

Having given the cases in considerable detail, I need not here say anything further in the attempt to substantiate the diagnosis as to hereditary syphilis. As it is often impossible to obtain clear histories, we are not unfrequently in these cases obliged to trust to the physiognomy, and especially to

the teeth of the patient for data upon which to ground an opinion.

In several of the cases adduced, the reader's estimate of the diagnosis will depend to a considerable extent upon his opinion as to the trustworthiness or otherwise of these signs. I rely, however, chiefly on the fact that these instances of choroidal disease in young persons are almost never met with excepting in conjunction with notched upper incisors and syphilitic physiognomy, for support to my opinion as to their true etiology. The cases constitute so marked a group and so closely resemble each other, that if a clear history could be established in but half, there would be fair grounds for suspecting like antecedents in the others also.

Concerning Cases IX, X, XI, and XII, which afford examples of the occurrence of cataract in young persons with syphilitic history I may direct attention to the following facts:—in none was the cataract congenital; in all there were evidences of inflammatory changes in other tissues of the eye; in three of the cases the cataract was unilateral only, and in the one in which the disease was double the opacity had reached very different stages in the two eyes. These facts seem to point to the inference that the opacity of the lens was in all of a more or less inflammatory character. Its occurrence in one eye only, might be explained by supposing that the changes in the lens had been brought about by acute inflammation of the adjacent structures, and had therefore taken place only in the eye most severely affected. Were the lens liable to become inflamed in syphilitic children, without the intervention of any other morbid condition of the adjacent parts, and simply as the result of blood poisoning, the disease ought to be—as keratitis and choroiditis of this form are—symmetrical. It is much more probable, however, that the lens has very little tendency to take on inflammation, and that it almost never does so excepting secondarily. I have never yet seen an instance of cataracts in the eyes of a supposed subject of inherited taint whose eyes were otherwise sound.

ON THE SO-CALLED AQUO-CAPSULITIS.

One of the propositions with which this paper was commenced, was that a majority of the affections hitherto classed as "Aquo-capsulitis," were due to hereditary syphilis. Although all will admit that it is time that this term—alike barbarous in its terminology and erroneous in the anatomical theory which it suggests—fell into disuse; yet a short space may suitably be here granted to affections which have been so designated. It has been applied much too widely by many writers. If we were to allow it to include all cases in which the posterior layer of the cornea and the surface of the iris were simultaneously inflamed, a large class would be formed, and respecting a majority, indeed almost all, there would be little difficulty in proving a syphilitic history, either hereditary or acquired. In many cases of interstitial keratitis when the cornea has regained its transparency sufficiently to allow of inspection of the iris, the latter is seen to have partially lost its lustre, looking thin and of steel-gray aspect, and not unfrequently to have contracted a few slender adhesions. Although the severity of the disease has fallen on the cornea it is clear that the iris has also suffered. During the attack, however, the iris has been shut off from view, and the disease consequently designated as keratitis. In the cases of acute iritis in syphilitic infants, the cornea, as I have shewn, is but rarely implicated. The only cases to which the term "aquo-capsulitis" ought ever to have been applied, are those in which with finely-dotted deposit on the posterior layer of the cornea the structure of that tissue remains transparent and allows of a tumid and inflamed iris being freely inspected. Cases in which this conjunction of phenomena exists, do occur, but as far as my observation has gone they are very rare. I am speaking, of course, of cases in which the iritic affection and the inflammation of the posterior layer of the cornea are nearly equal in degree. In almost all cases of iritis from acquired syphilis, the sprinkled sand-like dottings behind

the cornea are present; but in these the stress of the morbid process is so evidently upon the iris that we never hesitate as to the designation. Now and then, however, after acquired syphilis the affection which supervenes in the eyes might fairly be called "aquo-capsulitis," the iris being affected but very slightly. Limiting the term under consideration as above proposed, I have seen but very few examples of the disease. About seven years ago I had under care for some weeks a girl of about 12, of Jewish family, in whom one eye was affected by slight iritis with punctate deposits behind the cornea. The corneal tissue never became opaque, and there was never any free effusion of lymph in the iris; the condition proved very intractable, but the opposite eye was never affected. There was no reason for suspecting hereditary syphilis. The following three cases comprise all that I have had under care at the Ophthalmic Hospital, and in one of these I did not see the patient during the attack, but only formed my opinion as to its nature by the permanent condition which had been left. In only one of the three was there the slightest reason to suspect hereditary syphilis, and I am therefore inclined to the opinion that cases of this type are for the most part not dependant upon that affection; further evidence is, however, needed on this point.

Case I.—Dotted deposit on the posterior layer of one cornea, with slight iritis—No suspicion of hereditary taint.

Alice G., single, aged 20, of clear complexion, rather pretty, and not presenting any trace of the physiognomy of hereditary syphilis, was admitted on June 9th, 1859. She had a perfectly regular set of teeth, of good form, and although pallid, considered herself in excellent health. Menstruation had always been regular. She was the sixth of her family, and all her brothers and sisters were reported to be in good health. The affection for which she applied consisted in a group of dotted deposits on the posterior surface of the right cornea. The largest were near the centre, and

but few extended higher than the equator of the eye, whilst downwards they occurred almost as low as the margin of the cornea. The pupil acted very sluggishly but was of normal size. Several tags of adhesion between the pupillary margin and the capsule of the lens were visible, but the iris itself was of good colour, and did not look as if it had ever been acutely inflamed.

From the history given it appeared probable that these deposits had been present for about two months. Six months ago the eye had been inflamed but the sight did not at that time suffer. The other eye had never been in the least affected.

The remedies prescribed were blisters and mereury, the latter in grain doses of calomel every night. Under these, in the course of three weeks, great improvement resulted, and the deposits were so far absorbed as to allow of her reading the smallest print. Still, however, although much diminished in thickness, the individual dots of deposit were, at the time of the girl's last visit very easily discernible.

Case II.—Iritis (slight) with punctate deposits in the posterior layers of the cornea in a healthy girl—Suspended menstruation—Improvement under the iodide of potassium.

Emily B., aged 16, was admitted on March 3rd, 1859. In both eyes exactly similar conditions existed, the posterior layers of the corneæ presenting numerous punctate deposits, and the irides being slightly discoloured, more especially near their free margins. The deposits in the corneæ were more numerous in their lower halves than their upper ones, and occupied nearly the same position as those in Case I, being, however, much less extensive. The attack had commenced two weeks before admission. The eyes were irritable, but there was no great intolerance of light. She had not menstruated for three months. With regard to her diathesis, my notes state "she is tall, well grown, florid, and fairly healthy looking; teeth good in every respect."

The treatment adopted consisted of the exhibition of the iodide of potassium in five-grain doses three times a-day. Under this she improved very decidedly. Menstruation occurred about a fortnight after her admission, and on March 24th the notes state that the corneal opacities had almost disappeared.

Case III.—Dotted deposits (permanent and earthy) on posterior layers of both corneæ—Evidences of past iritis—Hereditary syphilis probable.

Edwin R., aged 14, came under my care in June, 1859. On the posterior layer of both corneæ were numerous isolated dots of white deposit, which looked as if they consisted, in part at least, of chalk (Mr. Dixon quite agreed with me in this opinion). These had resulted from an inflammation which had occurred four years ago. There were also some slender tags of adhesion between the pupillary margin and the capsule of the lens. He had fair vision, and what of imperfection existed, was fully accounted for by the state of the corneæ. The condition of the latter was so peculiar and illustrated so well the disease under consideration that I had a sketch taken (see Plate X, Fig. 2). The boy was very decidedly of syphilitic physiognomy as was also his elder brother who came with him. Unfortunately I had no opportunity of obtaining any history of his infancy. As the changes were undoubtedly permanent no treatment was adopted.

TINEA TARSI—FALLING OF THE LASHES AND MUCO-PURULENT OPHTHALMIA, AS CONNECTED WITH HEREDITARY SYPHILIS.

The wish to notice in this paper all the affections of the eye and its appendages, which I have hitherto observed in connexion with inherited syphilis, induces me to group together the above-named. They are all alike in this, that they are by no means peculiar to the subjects of hereditary

taint. Of iritis, choroiditis, kerato-iritis, and interstitial keratitis, as met with in infants and young persons, I venture the assertion that in a vast majority of instances, they are directly due to that cause. With tinea tarsi, etc., however, it is wholly different, they are very commonly simple affections, and very rarely syphilitic. To take first—

Tinea tarsi.—When this disease is of syphilitic origin, whether inherited or acquired, it may usually be distinguished by the circumstance that small abruptly-margined patches of excoriation extend away from the lashes into the cutaneous surface of the lids. These patches are irregular in shape, and are most commonly observed near the angles. They give to the lids an appearance of great irritation and soreness. Again, syphilitic tinea tarsi is apt to be very obstinate in treatment, unless constitutional specifics are employed. It is interesting to remark, that when tinea tarsi, in a severe form is not syphilitic, it is still usually a secondary phenomenon to some specific disease. Measles is undoubtedly a most frequent cause; scarlet fever and small-pox are so more rarely: it is by no means rare, and often complicates the form of keratitis about to be described. The following may be cited as a good example:—

Case of obstinate tinea tarsi following a syphilitic rash in a young infant.

A pallid but fairly stout boy, aged 2, was brought to me at the Metropolitan Free Hospital in June, 1858, on account of what looked like catarrhal ophthalmia with severe tinea tarsi. The tinea had existed for eighteen months, the mucous discharge and conjunctival congestion for only a fortnight. Had the disease followed the measles, I asked, “No,” was the reply, “but he had a bad rash out on his body before the eyes came sore.” There was that in the way the mother spoke of the rash which made me think that she wished the term to convey something of particular and

mysterious importance, and having observed also that the boy's nose was sunken, and that the little excoriated patches on the edges of the lids were present, I at once asked as to syphilis. A full history of the disease both in the mother and infant was at once freely given, and the requisite remedies were accordingly prescribed.

Falling of the lashes.—I need say no more of this symptom than that it occasionally happens in syphilitic infants. It has, no doubt, the same relation to the original disease as the alopecia which is not unfrequently observed in adults as a secondary symptom.

Muco-purulent Ophthalmia.—The reason why purulent ophthalmia is so common in syphilitic infants is, no doubt, to be found in the fact that the mothers of such usually suffer from syphilitic leucorrhœa. The contagion is usually conveyed to the infant's eyes during birth, and the disease is to be regarded as a local one. I have, however, seen so many instances of muco-purulent ophthalmia beginning in infants at intervals of a month or two after birth, and in association with other symptoms of inherited syphilis that I cannot but think that this form is often of constitutional origin. The conjunctivitis is probably of the same character as the inflammation of the Schneiderian membrane of the nose, to which the snuffles, nasal discharge, etc., is due. It is rarely so acute as the true purulent ophthalmia.

PARALYTIC AFFECTIONS OF THE MUSCLES OF THE EYE.

(continued)

BY DR. JOHN S. WELLS.

(Received April 5th.—ED.)

PARALYSIS OF THE OBLIQUUS SUPERIOR.

THIS, the last paralysis of the muscles moving the eyeball of which we have to treat, illustrates, perhaps better than any other, the correctness of the rules by which we are guided, and the value of thoroughly understanding the actions of the muscles of the eye in order to unravel the complication of symptoms, objective as well as subjective, called up by the paralysis of these muscles.

The deviation of the optic axis in paralysis of the *trochlearis* is so slight, that although the diagnosis may be made from the objective symptoms alone by one well conversant with this subject, many errors would undoubtedly arise if we had not fortunately in the subjective phenomena (the *diplopia*) so true and controllable a guide that we cannot very easily fail in our diagnosis. Although such eminent observers as Sczokalsky, Ruete, Bowman, Donders, etc., had made many interesting researches in connection with this subject, it was reserved for von Graefe to make the formal diagnosis of the paralysis of the superior oblique, and to base it upon clear and uncontrovertible symptoms.*

Let us now turn to the paralysis of the superior oblique of the left eye, and follow in our examination, the course which we have before defined, viz., an examination, first of the objective symptoms, and then of the *diplopia* presented

* *Vide* his admirable paper upon "The Physiology and Pathology of the oblique muscles of the Eye." Archiv für Ophthalmologie, vol. i, part 1.

by such a patient. He generally comes to us with the complaint that things in the lower half of his field of vision,—the floor, steps, etc.,—appear vacillating and double. At the first glance, perhaps, we do not notice any deviation in the optic axes. We direct the patient to look at an object held at a few feet distance, and find that as long as we move it in any direction *above* the horizontal median line both eyes follow it accurately, and are adjusted upon it; if we hold it in the median line, a very slight deviation of the affected eye (in our case the left), in an upward and inward direction, becomes manifest, and shows itself more and more distinctly the further the object is carried into the lower half of the field of vision, more particularly if we move it at the same time towards the right side of the patient. Upon closing the right eye the left makes an excursion downwards and outwards, to bring its optic axis to bear upon the object; the right eye making a greater associated movement downwards and inwards (to the left). There will also be an erroneous projection of the field of vision towards the side of the affected eye, or rather downwards and outwards; for if we tell the patient to strike quickly at the object with his hand, whilst his right eye is closed, he will aim too low, and too much to the left of the object, and thus miss it.

The difference in the height of the *corneæ* of the two eyes beneath the horizontal median line becomes more evident as the object is moved towards the right, the lateral distances here decrease; both the difference in the height of the *corneæ* and their lateral deviation decreases when the object is moved to the left side; but when it is carried vertically downwards the lateral deviation (convergent squint) increases.

These phenomena are easily explained when we call to mind the action of the Superior Oblique muscle. As its action is not called into play in order to bring about any of the movements of the eyeball *above* the horizontal median line, its default (from paralysis) will not be evident as long as the object is kept in the upper half of the field of vision, and consequently both optic axes will be accurately adjusted

upon it. Different will it be however, when we move the object into the lower half of the field of vision, for as the action of the *trochlearis* consists in moving the *corneæ* downwards and outwards, the eye will, when this muscle is paralyzed, lag behind in an upward and inward direction, giving rise to a convergent squint.

In conjunction with the *R. inferior*, the *trochlearis* moves the eye *vertically* downwards, if the latter muscle is paralyzed, the *R. inferior* will move the eyeball downwards, but, at the same time, inwards; thus causing a convergent squint, which increases in proportion as the eye is moved downwards.

The parallelism of the vertical meridians of the two eyes will be destroyed, and that of the left eye will be inclined outwards in consequence of the unopposed action of the *R. inferior*.

Upon closing the healthy right eye, and testing the mobility of the left, we, at the first glance, might deem it almost undisturbed; for it can be moved in the horizontal median line to the right and to the left, above this line vertically upwards or into the diagonal positions: if we now carry the examination into the lower half of the field of vision, and ask ourselves in what position of the eye will the inefficiency of the paralyzed *trochlearis* become most unmistakably apparent, we must answer, in the diagonal position, downwards and inwards (to the right in our case). In this direction we shall find the mobility positively lessened, as the action of the *trochlearis* is essentially necessary for this position, for we know that the *R. inferior* forfeits more and more of its action in lowering the *cornea* in proportion as the eye is moved inwards. The effect of the superior oblique upon the height of the *cornea*, on the other hand, decreases as the eye is turned outwards, in this direction it exercises most influence upon the V. M., but the difference in the parallelism of the V. M. M. of the two eyes does not obtrude itself upon our perception so much as the difference in the height of the *corneæ*.

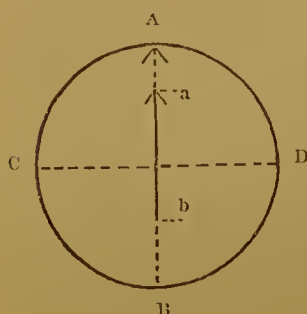
As the differences in the movements of the two eyes are but small in slight cases of paralysis (*paresis*) of the *trochlearis*, we gladly avail ourselves of the *diplopia* to assist our diagnosis, for by its aid we can appreciate differences in the position of the optic axes which might easily escape our objective examination.

As the squint is convergent, the *diplopia* will be homonymous, and as there is a difference in the height of the *corneæ*, the double images will show a difference in altitude. As the optic axes are fixed upon the object in the upper portion of the field of vision, the *diplopia* will be absent here, but it becomes apparent generally already in the horizontal median line, and the double images increase in proportion as the object is moved downwards. Owing to the convergence of the left eye, the rays from the object fall upon a portion of the *retina* internal to the *macula lutea*, and the image is consequently projected outwards (to the left), giving rise to homonymous *diplopia*; but as the left eye stands higher than the right, there will likewise be a difference in the height of the double images, for the rays from the object fall in the left eye upon a portion of the retina *above* the *macula lutea*, and the *pseudo*-image is therefore projected *beneath* that of the healthy right eye. As the convergence becomes greater (owing to the uncontrolled action of the *R. inferior*), the more the eye is moved downwards, the lateral differences in the double images will increase in this direction, but diminish when the eye is moved to the right or left side. In conformity with the fact that the Superior Oblique exercises most influence upon the height of the *cornea* when the eye is moved inwards, the double images will, in paralysis of this muscle, increase in height in this direction, but decrease as the object is moved over to the left of the patient.

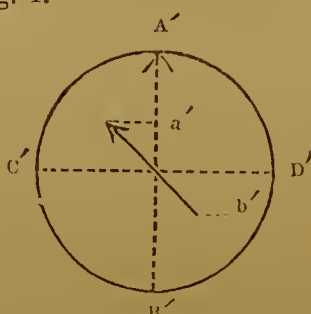
We next turn our attention to the *inclination* of the double images, gaining through this also a valuable aid for our diagnosis. When the *trochlearis* is paralyzed, the *R. inferior* can, in all the movements of the eye below the horizontal median line, exercise uncontrolled sway over the

V.M., and incline it outwards; the parallelism of the V.MM. of the two eyes is in this way destroyed, and they *diverge* at the top, the double images appearing to the patient to *converge*, as in Fig. I.

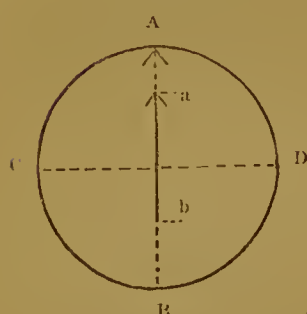
Fig. I.



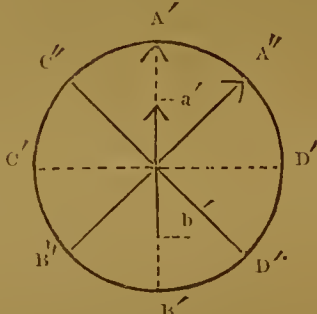
I (2).



II (2).



I (1).



II (1).

I (1.) The healthy right eye, whose V.M. (A B), is vertical.

II (1.) The left eye, affected with Paralysis of the Superior Oblique, in consequence of which the *R. inferior* exercises uncontrolled influence over the V.M. and inclines it outwards (A'' B''). The parallelism of the V.MM. of the two eyes is consequently

destroyed, for the V.M. of the left eye (A' B' II (1)) instead of being vertical is inclined outwards (A'' B''), so that the V.MM. of the two eyes *diverge* at the top (A B I (1) and A'' B'' II (1)).

The image (a b) of a vertical object falls in the right eye in the V.M. (I (1) a b).

In the left eye, however, the V.M. is inclined outwards (A'' B''), therefore the image (a' b') will not in this eye fall in the V.M., but in the *upper and inner* (A'' C'') and *lower and outer* (B'' D'') quadrants of the *retina*, the *pseudo-image* appears therefore to the patient to be inclined to the right and to converge at the top towards the image of the right eye. (a b I (2) and a' b' II (2)).

As the *trochlearis* exerts most influence upon the position of the V.M. when the eye is moved downwards and outwards,

the difference in the inclination of the double images which arises from paralysis of this muscle must become more and more evident as the object is moved over from the right to the left side of the patient, the differences in height of the images at the same time decreasing, the reverse will be the case when the eyes are moved from the left to the right.

The lateral differences in the double images are greatest when the object is moved vertically downwards and diminish towards either side.

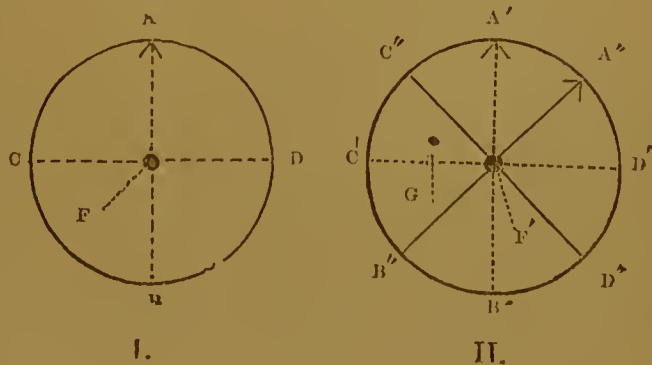
A curious phenomenon may show itself when the object is carried far down in the lower half of the field of vision, viz., that although the *cornea* of the affected eye still remains *higher* than that of the healthy eye, the *pseudo-image*, instead of being *beneath* that of the right eye, may now appear *above* it. I have before mentioned, when speaking of the paralysis of the *R. internus*, that this apparent anomaly is brought about by an excessive inclination of the V.M., and a consequent dislocation of the quadrants of the *retina*; if we remember this, we have no difficulty in understanding this phenomenon.

On account of the paralysis of the *trochlearis*, the left eye, when the patient looks downwards, lags behind in an upward and inward direction, as has been before pointed out; the rays from the object fall, therefore, in the upper and inner quadrant of the *retina*, and are projected outwards and downwards.

Fig. II will perhaps better explain what next takes place when the look is carried still further downwards.

Let I represent the *retina* of the healthy right eye. The vertical meridian (A B) and the horizontal meridian (equator) (C D) divide it into quadrants.

Fig. II.



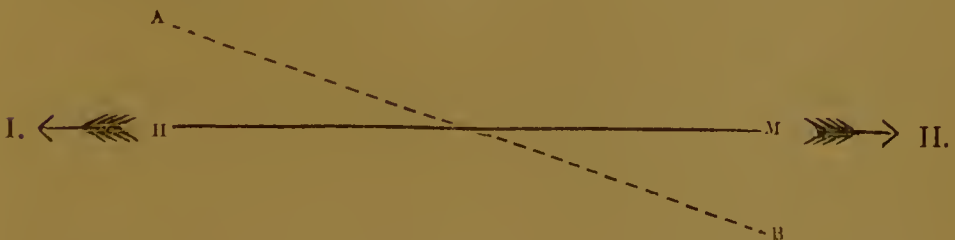
the *retina* of the left eye, which is affected with a paralysis of the Superior Oblique. A' B' is the vertical, C' D' the horizontal meridian. If the object be held slightly in the lower half of the field of vision its image will fall in I upon the *macula lutea* F, for the V. and H.M.M. retain their normal positions in this eye; in the left eye it will, however, be different, for on account of the paralysis of the *trochlearis*, this eye stands higher and more inwards than the right eye, and the image (G) of the object falls, therefore, not in the *macula lutea* (F' II), but to the inner side of the yellow spot and above it, viz., in the upper and inner quadrant of the *retina* (II A' C' G), and the *pseudo*-image is, therefore, projected to the left and *beneath* that of the healthy eye. These relations will be, however, completely changed when we carry the object far down, for the left eye will, in the attempt to follow it, be moved downwards by the unaided action of the *R. inferior*, which must at the same time bring about a great inclination of the V.M. (over which the *R. inferior* now exercises uncontrolled sway), and the V.M. is inclined outwards (A'' B'' II), and the H.M. lies in C'' B'', but the image (G) lies now, in conformity with these changes in the meridians, no longer in the upper and inner quadrants of the *retina* (A' C' II) but in B'' C'', the *lower* and inner quadrants; and the *pseudo*-image will, therefore, be projected to the left and *above* that of the right eye.

Another exceedingly interesting phenomenon is met with in paralysis of the Superior Oblique, viz., the *pseudo*-image appears to the patient to be nearer to him than that of the healthy eye. My friend Dr. Michaelis first noticed this, and von Graefe (*Archiv f. Ophth.*, vol. ii, part 2, p. 321), supposes it to be owing to a dislocation backward of the turning point of the eye, which is caused by the retrahent action of the *recti* muscles, which, being freed from the antagonistic opposition of the Superior Oblique, can pull the eyeball more into the orbit. The following facts appeared to favour this supposition:—The affected eye appeared sometimes to lie deeper in the orbit than the healthy eye, when pressure was

made upon the healthy eye its image receded more and more *towards* the patient, and, at last came into the same line with the *pseudo*-image (which, as we have stated, appears to lie *nearer* the patient) ; the lateral distances, as well as those in the height and inclination of the double images, remained unaltered as long as the pressure was uniform. If the pressure was exercised upon the affected eye, its image could be made to approach still nearer to the patient. Von Graefe thinks now however, that this symptom is not sufficiently explained by the retrogression of the turning point of the eye ; for were this the case, we should find in cases of paralysis of the *oculomotorius* (where the dislocation forward of the turning point of the eye evidently exists), that the image of the affected eye would lie further from the patient than the other ; this is, however, not the case. At present, therefore, we must abandon the attempt of explaining this phenomenon.

The line which divides the field of single vision from that of the *diplopia* does not run horizontally, but obliquely downwards from the right to the left. The reason of this is evident. The Superior Oblique acts most upon the height of the *cornea* when the eye is moved inwards, consequently the deviation of this eye, and its accompanying *diplopia*, must show itself sooner when the patient looks inwards than when he looks straight forward or outwards. The line which divides the field of single vision from that of the *diplopia* must, therefore, rise towards the right eye, above the horizontal line, but descend towards the left side, as in Fig. III.

Fig. III.



1. The field of vision of the right eye.

II. That of the left eye affected with paralysis of the *trochlearis*.

H.M. The horizontal median line.

A.B. The oblique line which divides the field of single vision (above) from that of the *diplopia* (below).

The carriage of the patient's head is peculiar. As the *diplopia* arises when the eyes are turned downwards, the patient bends his head forwards, thus bringing the object as much as possible into the upper half of his field of vision, and so he manages to lessen the territory of the *diplopia*; but he also inclines his head sideways to the right, and thus succeeds in bringing the object more into the left half of his field of vision, which must be of manifest advantage to him, as we have seen that the *diplopia* arises sooner in the right half of the field of vision.

As we have already explained the action and mode of application of prismatic glasses, and the difference which exists in their employment according as our intention is merely to free the patient from the annoyance of the *diplopia*, or to cure the paralysis by the gradual exercise of the affected muscle, we can go over at once to the consideration as to, how we are to apply prisms in our case?

As the left eye deviates upwards and inwards, the retinal image of the object will fall upon a portion of the *retina* above, and to the inner side of the *macula lutea*; if we, therefore, apply a prism with its base diagonally downwards and outwards, the rays will be refracted proportionably to the strength of the prism, downwards and outwards, and thus correct the deviation upwards and inwards. As the difference in the height of the double images is greater than their lateral distances, the base of the prism must be inclined more downwards than outwards.

As it is not always easy to establish the diagnosis of the paralysis of the *trochlearis* when the deviation is slight, and the patient obtuse, and but little susceptible of the accurate appreciation of the differences in the double images, it is important that we should consider whether we could easily

confound the paralysis of this muscle with that of any other.

It was seen that when the patient looked at an object held in the horizontal median line, or in the lower half of his field of vision, his left eye lagged behind in an upward and inward direction.

This could only be brought about by the paralysis of a muscle whose action is to pull the *cornea* downwards and outwards, or by the contraction of a muscle whose office consists in moving the eye upwards and inwards.

Could we confound it with a paralysis of the *Rectus inferior*?

This muscle certainly moves the eye downwards, but at the same time inwards, and therefore if paralyzed the eye would deviate from the object in an *upward* and *outward* direction, giving rise to a *divergent* squint with *crossed* double images; but this does not at all coincide with the symptoms laid down as showing themselves in paralysis of the *trochlearis*, for in our case the eye deviates *upwards* and *inwards*, the squint is convergent, and the *diplopia* homonymous.

We have however in the double images, and particularly in the differences in the direction in which their height and inclination increase, another important guide for our differential diagnosis.

When treating of the paralysis of the *R. inferior* we found that the differences in the height of the double images became greater as the eyes were moved outwards (to the left), their inclination decreasing in this direction and *vice versâ*, now just the reverse of this happens in paralysis of the superior oblique.

We cannot very well mistake it for a contraction of the *R. superior*, for, apart from the differences in the double images, the deviation of the optic axis would not show itself just in those movements in which the *R. superior* is relaxed (below the horizontal median line), and be wanting in the movements of the eyes in the upper half of the field of vision,

in those movements in fact in which the *R. superior* is more or less called into play.

After a paralysis of the superior oblique muscle has existed for a longer or shorter space of time, it frequently happens that a secondary contraction of the inferior oblique is brought about. This event not only complicates the diagnosis and somewhat changes the symptoms of the paralysis, but also clouds the prognosis very materially, for even although we should succeed in curing the paralysis, the changes in the muscular structure of the inferior oblique will not undergo a restitution *ad integrum*.

In these cases an operation is often called for in order to free the patient from the very annoying and confusing *diplopia* which now pervades, more or less, the whole of his field of vision.

If a secondary contraction of the inferior oblique is superadded to a paralysis of the *trochlearis*, the patient would present the following symptoms:—

The *cornea* of the affected (left) eye stands higher than that of the right eye throughout the whole of the field of vision. Below the horizontal median line there is a convergent squint, owing to the paralysis of the *trochlearis* (whose action is to move the *cornea* downwards and outwards); above the horizontal median line the squint becomes divergent, for in consequence of the contraction of the inferior oblique, the eye is pulled more upwards and outwards.

If, while the object be held slightly in the lower half of the field of vision, the right eye is closed, the left will make an excursion *downwards and outwards*, in order to bring its optic axis to bear upon the object, but when the latter is carried into the upper half of the field of vision and the experiment repeated, the eye will move *downwards and inwards*.

Below the horizontal median line the *diplopia* was shown to be homonymous, the image of the left eye being also *below* that of the right; above the horizontal line the double images become *crossed*, as the squint is here divergent, the

pseudo-image appears however still *beneath* that of the healthy eye.

In accordance with the action of the inferior oblique the differences in the height of the double images will increase when the eyes are moved towards the right side of the patient, the inclination of the images decreasing in this direction, towards the left side these differences will be just reversed. Owing to the hyper-action of the inferior oblique the V.M. is turned outwards, the parallelism of the V.MM. is therefore destroyed, and they diverge at the top; the images being crossed appear to the patient also to diverge at the top, so that the *pseudo*-image seems to be inclined towards his right side.

We are guided in the operative treatment of these cases by the same rules as are applicable to those in which we perform tenotomy for the purpose of freeing a patient wholly or partially of *diplopia*. As I shall have to treat fully of this in my next paper, I will defer till then the consideration of this part of our subject.

In order to prepare some of my readers for every contingency which may arise with regard to *diplopia*, I must be allowed to call their attention to a state of the *retina* which we meet with in some cases of squinting, and an ignorance of which might lead them either to doubt the assertions of the patients, or perhaps even the validity of the rules which we have laid down with respect to the different forms of *diplopia*.

The abnormality to which I would call their attention is *incongruence of the retina*. We find in these cases a very peculiar state of the double images, for instance, in a *strabismus convergens* the *diplopia* should be homonymous (the reasons for this have been already stated), and the distance between the double images should correspond to the degree of deviation of the optic axis; we find these conditions, however, completely changed in an incongruent state of the *retina*. Even if the double images are homonymous in a convergent squint, the distance between them is not at all commensurate with the size of the squint; or, on the other hand, we may have a *convergent* squint with *crossed* double images, or a *divergent* squint with *homonymous diplopia*. We must not, however, when we meet with such anomalies in the *diplopia*, at once attribute them to an *incongruence* of the *retina*, but must examine whether the patient has not perhaps, an abnormal curvature (facets, etc.) of the *cornea*, irregularities of the refracting media, luxation of the lens, etc.; for these might act as a prism, and cause refraction of the rays of light.

We must also distinguish cases of real incongruence of the *retina* from

those in which, owing to long continued *strabismus*, the most sensitive portion of the *retina* has become transposed to a portion of the *retina* (internal or external) to the *macula lutea*.

According to Von Graefe, the cases of incongruence of the *retinae* may be divided into two categories.*

I. The healthy eye *fixes* the object with its centre, upon closing this the affected eye does not adjust its *macula lutea* upon the object, but a point of the *retina* lying internal (or external) to the *macula lutea*: this point acts, in fact, as a substitute for the centre of the *retina*, prevailing over it in the energy of perception, but being also *identical* in relation with the *macula lutea* of the healthy eye.

II. Each eye, when tried separately, *fixes* the object with the *macula lutea*; but these two points are not identical, for when both eyes are opened *diplopia* arises.

Let us first suppose this in relation to convergent squint.

When both eyes are open, a point lying internal to the *macula lutea* will be identical with the *macula lutea* of the healthy eye, and the vertical line which divides the *retina* into a right and left half does not (as in the normal eye) fall in the centre of the *retina*, dividing it into two equal halves, but is situated to the inner side of the centre, so that when rays from an object fall upon the *macula lutea*, or even portions of the *retina*, lying more or less internal to it, these points will act as if portions of the *retina* external to the *macula lutea* had been stimulated by the rays, for the image is projected *inwards* across that of the healthy eye, and thus it comes to pass that although the squint is convergent the double images are crossed.

The case will be reversed when the vertical line lies to the *outer* side of the centre, for then the *macula lutea* and certain parts of the *retina* lying to the outer side of it will act as if they laid *excentrically* to the inner side of the yellow spot, and will consequently project images *outwards*, so that in this case we may have a *divergent* squint with *homonymous diplopia*.

That the vicarious point of identity in the affected eye is not that which enjoys the best vision, is sufficiently proved by the fact that when the healthy eye is closed, the affected eye adjusts its centre upon the object and does not deviate to the right or left side of the object, as would be the case if a lateral *excentric* portion of the *retina* enjoyed a higher amount of vision than the *macula lutea*.

It very frequently happens that after a *strabismus convergens* or *divergens* has existed for some time, the faculty of *mutual vision* with the other eye (*Gemeinschaftliches Sehen*) is extinguished in the squinting eye in a portion of the *retina* lying horizontally *inwards* or *outwards* of the *macula lutea* (according as the squint is convergent or divergent); if we then apply a prism with its base, in the first case *inwards*, in the second *outwards*, we fail to arouse *diplopia*.

We have however in these cases only to apply the prism with its base

* Archiv, vol. i. part 1. page 82; part 2, page 294. Also two cases in Alfred Graefe's *Motilitätsstörungen des Auges*, p. 228.

vertically upwards or downwards. If it be a convergent squint with incongruence of the *retinæ* the double images will now show not only a difference in height, but be crossed, or even if the double images are homonymous, their lateral distances will be quite disproportionate to the amount of the squint.

We find a convergent squint with the point of identity with the *macula lutea* of the healthy eye lying *internal* to the yellow spot, of far more frequent occurrence, than that this point lies external to the yellow spot, giving rise to divergent squint and homonymous *diplopia*.

At present no satisfactory explanation has been given of incongruence of the *retinæ*; Von Graefe has not found it so rare an occurrence as he at one time supposed it to be. If I mistake not, he has met with it in about *one-third* of the cases of *congenital strabismus concomitans*.

By trying prisms of various strength we may sometimes succeed in ascertaining whereabouts in the affected eye the abnormal point lies which corresponds in identity with the *macula lutea* of the healthy eye: for instance, in convergent squint with crossed double images we apply a prism with its base inwards before the squinting eye, and increase the strength of the prism until the distances between the double images become less and less, and they are at last melted into one image. Frequently, however, the position of this abnormal point of identity is not to be established (it is *ideal*), for we may, with the aid of prisms, succeed in bringing the crossed double images somewhat nearer to each other, but we cannot unite them or change them into homonymous images.

It is evidently of the greatest importance to ascertain before the operation of tenotomy whether or not incongruence of the *retina* exists, for its presence will most likely cause us to modify, or perhaps even abstain altogether from, the operation.

Are we ever to operate in cases of incongruence of the *retinæ*?

Before we decide upon this question and upon the method or purpose of the operation, we must very carefully examine whether or not the patient possesses the faculty of uniting the double images (this, of course, we discover by the aid of prisms). This experiment is the more necessary as we often find that together with incongruence of the *retinæ* there often exists very great antipathy to single vision. The degree of capability of uniting the double images will guide us of course in operating.

We operate generally for one of two reasons.

I. For cosmetic reasons.

In this case we must be particularly careful not to call up *crossed* double images, for these would be exceedingly confusing and annoying to the patient. Let us, for instance, suppose that a patient suffers from a convergent squint of $1\frac{1}{2}$ -2 lines upon the left eye, and that an incongruence of the *retina* exists in this eye, shown by the *crossed* double images which arise when a prism is applied with its base vertically upwards or downwards.

On applying the base inwards no *diplopia* is caused, owing to the extinction of *mutual vision* in the inner horizontal portion of the *retina*. If we

however, apply a prism of very slight strength (2° – 3°), with its base outwards *crossed diplopia* is at once called up. Were we in this case to operate in order to free the patient of the deformity of squinting, we should subject him to the annoyance of crossed double images, the suppression of which would be exceedingly doubtful and improbable, for we find that it is far more difficult to suppress crossed than homonymous double images. In fact, it would be very likely that in order to render the double image less confusing by driving them further from each other, the left eye would make an excursion outwards, giving rise to divergent squint, which would certainly be more unsightly than a convergent one ; or, perhaps, in order to unite the images the *R. internus* would be contracted and a convergent squint again arise. In this case, therefore, particularly if the squint be but slight, it is better to abstain from an operation, different however would it be if the *diplopia* was homonymous, and the double images would be placed further from each other by the operation.

II. We may operate for the purpose of bringing the rays from the object upon that excentric lateral point of the *retina*, which is identical with the *macula lutea* of the healthy eye. This point of identity is generally however placed so very far to the inner or outer side of the *macula lutea* (in some cases it may even be *ideal*) that we would have to bring about a very great *strabismus convergens* or *divergens* in order to bring the rays upon identical portions of the *retina*.

As the cases of incongruence of the *retinæ* differ very greatly, we can only lay down general rules with regard to the treatment, leaving it to the operator to modify them in accordance with the exigencies of the case.

If there is a very *great difference* between the distances of the double images and the deviation of the optic axis, we must generally despair of the patient's uniting them even when the images are brought accurately over one another.

It is best, therefore, to operate for the squint and place the optic axis straight, for this will be an improvement in a cosmetic point of view, and will also be advantageous for the act of vision, and the double images will on account of their great distance (and more particularly if they are homonymous) not annoy the patient at all.

We need be still less tied by the consideration of the *diplopia* if this only shows itself when a coloured glass is placed before the patient's eye. Let us suppose, for instance, that a patient comes to us with an insufficiency of the *R. internus* of the left eye, he may perhaps be able to fix both optic axes upon the object, by dint of a little exertion ; but when the left eye is covered, or the patient is looking thoughtlessly before him, a divergent squint arises ; *diplopia* does not show itself except with a coloured glass held before the eye, and therefore would not incommode the patient. We should in this case certainly divide the *R. externus* of the left eye so as to allow the eye to adjust itself without any trouble upon the object, and should ignore the consideration of the *diplopia*.

If we do not discover the incongruence of the *retinæ* until after the opera-

tion, and the patient is much annoyed by the *diplopia*, we may unite the double images by prismatic glasses. It is often preferable to divide the prisms between the two eyes; for instance, if a prism of 12° is required to unite the double images, we may apply a prism of 6° to each eye, as this is for various reasons often more agreeable to the patient than having a strong prism before one eye.

Paralysis of the Orbicularis Palpebrarum.

We meet with this affection in all stages and degrees, from the slight *paresis* which is hardly perceived, and affords little or no annoyance from a flow of tears, to that which gives rise to *lagophthalmos paralyticus*, and all its accompanying evils.

The symptoms must therefore of course vary according to the degree of the paralysis, the individuality of the patient, and the amount of injuries from external irritants to which he may be exposed. We find that the eyelids cannot be completely closed, owing to the inefficient elevation of the lower lid, so that a chink of varying size exists between them. By an impulse of the will, the patient may succeed (more easily when the other eye is closed), in almost shutting the lids by the relaxation of the *levator palpebrarum*; if the latter is, however, also paralyzed, the upper lid hangs immoveably down, so that the patient is obliged to have recourse to his fingers in order to lift it.

The *lagophthalmos paralyticus* caused by paralysis of the *Orbicularis*, is present even during sleep, and continues generally in spite of reflex irritants applied to the *conjunctiva*.

In a case mentioned by Romberg however, the reflex action still existed while all voluntary motion was lost, so that when the patient's eye was subjected to a strong light, or touched with the hand, or when she sneezed, the eyelids closed completely. During sleep the eyelids were also completely shut.

Although so many different theories have been advanced to explain the manner in which the tears are absorbed, there remains now no doubt that the action of the *Orbicularis* muscle forms a *conditio sine quâ non* for their absorption

and in conformity with this view we find, that when this muscle is paralyzed, one of the earliest results is generally, that the tears flow in greater or less quantity over the lower eyelid and cheek. (I say *generally*, because we meet with so many people in whom the secretion is so very slight, that evaporation suffices for their removal, and in them the lacrymation shows itself only after some time as a result of external irritants.) The lower lid becomes somewhat everted, and stands off slightly from the eyeball, thus forming a furrow in which the tears gather. Soon the external air, and the constant irritation of particles of dust, etc., call up a hypersecretion of tears, and even perhaps a slight conjunctival catarrh; at the same time the conjunctival secretions, epithelial scales, etc., are not efficiently washed away, and bring about *xerophthalmos*, and even *keratitis pannosa*. In old people, whose muscular structures have lost much of their elasticity, these consecutive evils show themselves at an earlier period than in the youthful; and apart from any paralysis we sometimes meet with in them, a certain insufficiency of the *orbicularis*, which is the cause of a slight eversion of the lids, and consequent catarrh of the conjunctiva, and an increased flow of tears.

We have to seek the cause of this affection (Paralysis of the *Orbicularis*) in the paralysis of the branches of the facial nerve which supply the muscle. And according to the situation at which the facial nerve is affected, the paralysis will be confined to the *Orbicularis* alone, or to several, or even all the muscles supplied by the *portio dura*. It is a very important fact, which may be of great diagnostic value, that *lagophthalmos* is generally present in the isolated paralysis of the facial nerve, but is almost always wanting in cerebral *hemiplegia*. If I remember rightly, von Graefe has only *once* seen *lagophthalmos* in connection with apoplexy (and this happened to be a case of *lagophthalmos totalis*). Generally the *Orbicularis* remains unaffected. Hasse mentions, however, a case in which there was a very complete peripheral paralysis of the facial, caused by an inflammatory

parotidean swelling, in which, besides all the muscles of the face, those of the forehead and eyebrows were paralyzed, and yet the lids could be closed to a certain degree.

The causes of the paralysis of the facial nerve may be divided according to their situation into two classes,—the peripheral and the central.

Amongst the first, rheumatism furnishes a large contingent of cases, and may bring about a paralytic affection of this nerve within the course of a very few hours.

Tumours, exudative processes, abscesses, canceroid tumours of the parotid gland, or situated along any part of the nerve, may paralyze it by direct pressure.

Injuries, wounds, whether traumatic or operative, which divide one or more of its branches, may bring it about.

Todd also mentions excessive exertion, and the consequent impoverishment of the blood, and debility of the nervous system as a cause.

Amongst the cerebral causes, I need only mention the pressure of congested vessels, tumours, syphilitic exudations, apoplectic productions, etc., and processes situated at the base of the brain.

Our prognosis is of course dependent upon the cause. Can the latter be removed or relieved, it may be favourable; is it dependent upon some very grave cerebral lesion, it must be unfavourable, or at best very doubtful. The peripheral, and particularly the rheumatic paralysis warrants the best prognosis.

Our treatment must also be regulated and guided by the cause. In rheumatic affections we generally bring about a cure in the course of a few weeks by the aid of antiphlogistics, diaphoretics, blisters behind the ears, etc.; and particularly in these cases do we find great good arising from electricity; at first it should be applied at intervals of a day or two, but may afterwards be more frequently used; although it often effects a cure very speedily, we must not throw it up too soon in despair, as its beneficial effect may be retarded, and not show itself till it has been continued for some length of time.

For the *xerophthalmos*, numberless remedies have been recommended, and experiments made, in order to imitate as much as possible the composition of the lacrymal secretion : von Graefe has found frequent washing of the eye with milk the best topical application.

In cases where syphilitic deposits are suspected we give iodide of potassium ; in cachectic or serofulous subjects, cod liver oil and tonics may prove advantageous. If there is much *hyperemia* or congestion, leeches to the mastoid process and derivatives are indicated.

Should, however, the *lagophthalmos* and *ectropium* of the lower lid produce much irritation and inflammation, we must have recourse to the operation of *tarsoraphia* ; we may operate upon the *ectropium* separately, but it will generally be preferable to combine the two operations. *Tarsoraphia* was first practised by Wallter, and has since his time been much employed with varied success. An important modification of this operation has been introduced by von Graefe, who has succeeded in obviating the evils which were too often attendant upon the old form of operation.*

Abnormalities in the movements of the Iris.

The movements of the *iris* ensue upon the application of certain stimuli, which may be reflected from the brain, or *medulla oblongata* upon the *N. oculomotorius*, or which may be imparted to the *iris* by direct irritation of the third pair. Budge has found that irritating the sympathetic nerve as low as the inferior cervical ganglion had the effect of dilating the pupil. When light falls into the eye the pupil contracts, and this is not owing to direct irritation of the ciliary nerves distributed to the *iris*, but to reflex action from the optic nerve ; for the *retina* being stimulated by the light this irritation is propagated to the *encephalon*, and is thence reflected to the branches of the third going to the *sphincter*

* *Vide* von Graefe's paper upon *Tarsoraphia*, in his *Archiv*, vol. iv. part 2, page 201.

pupillæ. That this is caused by reflex action we can prove by the fact that if we cover one eye with our hand and allow light to fall into the other, the pupil of the latter eye contracts, but so also will that of the covered eye (although perhaps in a somewhat slighter degree); if we, however, let the light fall into an amaurotic eye, its pupil will not contract, but the contraction will ensue also in this eye when we allow the light to fall into the healthy eye; and this fact proves also that the immobility of the *iris*, when the light entered the blind eye, was not due to a paralysis of the third pair.

The movements of the *iris* are also intimately connected with the accommodation of the eye. The pupil dilates when the object is carried far away from the eye, and contracts when the object is approached closely; most likely the contraction of the pupil which takes place upon the contraction of the *R. internus* is more or less connected with this. Irritation of the sensitive branches of the fifth pair (and particularly those of the ophthalmic branch) causes contraction of the pupil; for instance, we see this in certain *ophthalmiæ*, in cases where foreign bodies irritate the *cornea*, *conjunctiva*, etc.

The *mydriasis* caused by belladonna appears to be due to a twofold effect, viz., paralysis of the branch of the third nerve, which supplies the *sphincter pupillæ*, and the irritation of the sympathetic branch which goes to the *dilatator*. The loss of accommodative power which takes place during the atropine-*mydriasis* is most likely chiefly due to the simultaneous paralysis of the *tensor choroideæ*.

The pupils also contract during sleep (even in the completely amaurotic), and Ruete supposes this to be due to a decrease in the sensibility of the nerves of sensation, for when the *N. trigeminus* is cut through (or according to Budge even only pressed), the pupil becomes narrower.

The movements of the *iris* have long been considered as affording a great aid in detecting cases of simulated blindness.

If a person, for instance, denies having even perception of light in one eye, and it is yet found (the other eye of course being closed) that its pupil contracts upon the entrance of light, we are in almost all cases justified in pronouncing this a case of simulation. In very rare instances, indeed, this reflex action of the pupil upon a stimulus applied to the optic nerve may exist, and yet the patient may be completely deprived of any perception of light; we should find this in cases where some impediment (tumour, etc.) is situated between the *corpora quadrigemina* and *sensorium commune*, which would annul the connection between the reflecting portion of the brain, and the *sensorium*.*

Although these cases are of exceedingly rare occurrence we should be always upon our guard not to rely too implicitly upon the mobility of the *iris* as a sure means of detecting fraud. Von Graefe mentions a case of this kind where a boy had, through a fall upon the forehead and consecutive *periostitis* and *caries orbitæ*, become completely blinded upon both eyes. The left pupil was without any reaction when this eye alone was illuminated, but the pupil of the right contracted most distinctly when even a moderate amount of light fell into this eye. And yet the patient had not the slightest perception of light.

As it is a question of great importance how best to detect cases of simulation, I may be permitted perhaps to call attention to a very simple method proposed by von Graefe, viz., the application of prismatic glasses.†

If a person complains of having lost the sight of one eye, we hold a prism with its base turned upwards or downwards before the healthy eye. If *diplopia* arises and the double images stand one above the other and correspond to the different positions of the prism, we can at once declare this to be a case of deception. The fact that we put the prism before the healthy eye puts the patient off his guard, for he does not of course suppose that this proceeding can have any reference to his affected eye.

Mydriasis.

The pupil is very much dilated and the mobility of the *iris* is almost completely destroyed. Vision also is generally more or less affected, owing chiefly to the confusion caused by the dispersed rays and by the dazzling.

This, however, varies greatly; some patients are but very little (if at all) dazzled, and others have great power of suppressing dispersed rays. If we hold a piece of cardboard with a small hole in it before the dilated pupil the dispersed

* Contractions of the pupil have been noticed in persons blind of both eyes, when the eyes were moved in different directions.

† V. Graefe's Archiv, vol. ii, part 1, p. 266.

rays will be annulled, and the patient will generally be able to see well.

We divide *Mydriasis* into two classes:—

I. The *mydriasis paralytica* which is owing to a paralysis of the branch of the third, which goes to the *sphincter pupillæ* and causes its contraction.

II. *Mydriasis spastica* brought about by the increased action of the eiliary branches of the sympathetic, which are distributed to the radiating fibres of the *iris*.

We have already called attention to one form of *mydriasis paralytica* in a former paper, viz., that connected with paralysis of the *oculomotorius*. In these cases the pupil is not dilated *ad maximum*, but only to about the same degree as in a dark room, its diameter measuring about $2-2\frac{1}{2}$ lines. No change takes place in its size during accommodation, or during the different movements of the eyeball. Neither does the entrance of light into the affected or into the healthy eye, bring about a contraction of the pupil. But upon application of atropine the pupil dilates *ad maximum*.

We meet with another example of paralytic *mydriasis* in those cases in which the intra-ocular pressure is greatly increased (*glaucoma* for instance). The pupil is then dilated and sluggish, and this is not due as might be supposed to the impairment of vision, but to the pressure upon the eiliary nerves going to the *sphincter pupillæ*, for were the former the case the pupil would contract upon accommodative changes, and upon the entrance of light into the healthy eye, which is however not the case. The dilation is generally irregular, and at first not great, but at a later stage of the disease the pupil may become excessively dilated, owing to a progressive atrophy of the texture of the *iris*.

We see *mydriasis* occurring with *ptosis* after draughts of cold air, etc., and in connection with rheumatism. Mackenzie has observed *mydriasis* after blows on the eye or on the head, and wounds of the brow or temple without any affection of the optic nerve.

Mydriasis may also accompany some diseases of the

brain, as for instance *hydrocephalus*, apoplexy, paralytic affections of the cerebral nerves, etc. Contraction of the radiating fibres and consequent *mydriasis* is seen in cases of irritation of the sympathetic in certain gastric disorders. Von Graefe has also made the important observation that *mydriasis* (particularly one-sided) is sometimes a precursor of mental diseases.

The treatment must vary according to the cause. In rheumatic cases we may try blisters behind the ear and colchicum. Where it occurs in weakly constitutions we must prescribe tonics, and the bitter ones are particularly likely to be serviceable.

The *Secale cornutum* has been strongly recommended by some, and appears to have answered in some cases, but in others to have had not the slightest effect. Neuhausen has spoken highly of the *Euphorbia cyparissias*.

The spontaneous form of *mydriasis* which is accompanied by indistinctness of vision, paralysis of the accommodation, and *hyperopia* is best remedied by the methodical use of convex glasses. We may also sometimes succeed in relieving *mydriasis* by making a therapeutic use of the impulses which physiologically cause a contraction of the pupil. Von Graefe, after trying in vain many so-called specifics, has had recourse to this method, and has found it frequently successful.* We cannot make much use of the entrance of light into the eye, because generally the affected eye undergoes no contraction of the pupil under this impulse, and the effect of the concentrated light might be injurious to the *retina*. We may order the patients to practise their accommodation by reading, through a convex glass, small print held near the eye, and if the pupil contracts in these cases we may hope to derive some benefit.

Von Graefe has however seen better results from a forced and methodically repeated closure of the eyelids and has suc-

* *Vide* v. Graefe's Notice on the treatment of *Mydriasis*, Archiv, part 1, page 315.

ceeded by such means in improving old cases of *mydriasis* which had withstood all other remedies. It is a well known fact that the irritation of the branches of the fifth pair which are distributed to the eyeball and nose, is followed by a contraction of the pupil. Upon this fact are based the many irritant methods which have frequently been lauded for their virtues in curing *mydriasis*. It has been recommended by Serre to apply caustic (for about a second) to the *cornea* near the junction of the sclerotic, but this may frequently give rise to very great irritation. It may perhaps be applied to the sclerotic *conjunctiva* near the edge of the *cornea* with beneficial effect. Von Graefe has found the dropping in of tincture of opium effective in some cases, but these means are very unreliable at the best.

Myosis.

This is sometimes so excessive, that the pupil is smaller than a pin's head. We frequently meet with it in persons who are by business obliged to regard for a long time minute objects, such as watchmakers, lithographers, etc. They are only annoyed by the lessening of the intensity of the light, so that they cannot work when it is getting dark. It does not, however, as is frequently supposed, produce a narrowing of the field of vision, for we cannot compare it to the state which is caused by looking through a very minute opening in a piece of cardboard, for here the aperture is a certain distance from the eye, and must arrest many of the lateral rays of light. But in *Myosis*, the narrow orifice is situated in the eye itself, and the lateral rays would be only hindered from entering, if the substance of the *iris* had become thickened.

Myosis may be caused by irritation of the third pair, as in cases of *typhus*, inflammation of the brain, etc.; Himly says it also occurs in *hydrophobia*. In *hyperæsthesia* of the *retina*, it is caused by reflex action

Decreased or impeded action of the sympathetic has been

observed to be followed by *Myosis*. Under this head comes the interesting case reported by Dr. von Willebrand,* in which swollen cervical glands caused pressure upon the cervical portion of the sympathetic, and consequent *Myosis*. Gairdner also mentions a case of aneurism of the subclavian artery, accompanied by it. Enlarged tonsils may also cause it.

Myosis has been found accompanying diseases of the *medulla oblongata*, *tabes dorsalis* (Romberg), and is frequently a precursor of spinal *amaurosis*; in the latter case, Arlt has sometimes seen the pupil so contracted, that it appeared about half a line in diameter.

The treatment of *Myosis* must depend completely upon the cause. If it is produced by tumours, etc., these may perhaps be removed. Willebrand prescribed in the aforesaid case iodide of potassium internally, and an ointment of mercury, and iodide of potassium externally: under this treatment the hypertrophied lymphatic glands decreased in size, and the *iris* regained its mobility. In that form which we meet with in watchmakers, etc., we can only urge frequent rest of the eyes. In the *Myosis* which accompanies *hyperæsthesia* of the *retina*, we must generally avoid all depressing remedies, but give tonics, a good diet, allow the patient plenty of fresh air and exercise; we moderate the light but must beware of rushing into the other extreme of allowing the patients to keep hidden in total darkness, for the sensitiveness of the *retina* is thus very much increased. The best treatment is to give them a pair of cobalt blue spectacles, and to accustom them gradually to a stronger and stronger light, and thus we frequently succeed in curing patients in a few weeks who have sat for months and months wrapped up in shawls and shrouded from even the slightest ray of light.

The local treatment of *Myosis* is generally of no avail.

* Graefe's Archiv i, p. 319.

15, Upper Brook St
W.
Nov. 20th/80.

My dear Sir

I am much obliged
to you for your paper on the
Parasitic Ova - which I
received at the Hospital yesterday
when I was there on my day
of attendance - the subject was
one of course entirely new to
me

I remain very dear Sir

Yours faithfully

J. F. Streetfield



Hippus.

When there is a continual rapidly changing dilatation and contraction of the pupil, quite independent of the entrance of light, it is called *Hippus*. It is a state of the *iris* analogous to *nystagmus*. It must not be confounded with *iridodonesis*, that tremulous state of the iris which ensues after cataract operations, dislocation of the lens, or *synchisis* of the vitreous humour; the movements of the *iris* are in this case of a wavy fluctuating character quite different from those of *Hippus*.

We often find *Hippus* complicated with *hyperæsthesia retinæ*, *nystagmus*, etc., and it is said often to mark that period in *hydrocephalus* in which the irritation of the membranes of the brain passes over into effusion or exudation.

The treatment must, according to the cause, be antispasmodic, antiphlogistic, tonic, etc.

(to be concluded).

FIRST MEMOIR
ON
CORELYSIS.

DETACHMENT OF IRITIC AND OTHER ADHESIONS OF THE PUPIL TO THE LENS OR CORNEA, OR TO A "FALSE MEMBRANE," (REINSTATED PUPIL), WITH A FEW REMARKS ON THE EXTRACTION OF CATARACT WITH PUPILLARY ADHESIONS.

BY MR. STREATFEILD.

In the first number of this Journal (October, 1857), I have quoted the first case in which I operated upon false membranes in the pupil, according to my new ideas of remedying this state as a consequence of iritis. I also mentioned a novel method I had adopted of detaching the iris from the lens when only in some parts adherent. These cases have

been altogether successful—the patient who had the false membranes I saw a few weeks ago, he had had no more iritis, the pupil of the right eye was, as I have explained in the former account, imperfectly cleared, and so it was left; but the other was quite unobstructed, and remained as it was after the operation, to the same extent answerable to light, nearly regular in shape, and its area quite free: (he is now a stock-keeper in the warehouse in which he had been engaged as packer), he could read any type or an inscription in rather small letters on a distant wall. Further experience encourages me to pursue my original plans of freeing the iris whenever it is adherent at its pupillary margin, whether to the lens or cornea, or to a false membrane in the pupil itself. Of course, I have already learnt some desirable modifications of my early system of treating these cases, and yet, perhaps, I should have waited till my experience is greater, but I have been anxious to bring forward this matter in some form, that it may be advanced or corrected by the scientific knowledge of more practised operators.

I propose, for brevity's sake, for comprehensiveness and common understanding, to call any surgical operations, such as those to which I here devote myself for the detachment of the pupil from whatever adhesions it may have, *Corelysis*.*

In almost all cases I have been in the habit, when the pupil only has been involved in any adhesion, of operating to free it, and lately I have learnt better which are suitable for the operation. The usual practice has been, I believe, to do nothing for partial adhesions of the iris or indeed in any of these cases† surgically, unless vision was *very much* impaired at the time; but this forbearance is, I think, a mistake, and corelysis should be done in very many cases of

* *Corēlysis* = Pupil freeing, from *Κόρη* and *λύσις*.

† Mackenzie says, "In *synechia anterior* of limited extent, the adhesion may sometimes be separated by means of a needle introduced through the cornea, or the adherent part may be cut across." He only thus briefly, however, alludes to this. Middlemore also mentions this as a preliminary to "artificial pupil" with *anterior* adhesions. I find no allusion to the separa-

the various kinds I have above mentioned; the risk of wounding the lens or producing another inflammation by operating, being much less than has been supposed. Besides that all iris-adhesions should be, if possible, detached and not left, I wish to inculcate that a pupil should be, and often can be, made in the former situation of the natural pupil ("reinstated pupil"), and not only as near to it as possible, as is usually proposed, and that when the pupil is entirely blocked up (occlusion), and no part or space left free, the lens behind it is generally transparent, and the lens capsule often may be cleared by removal or opening out of the occluding membrane. Diseases of the eye as a consequence of syphilis, directly or indirectly, are exceedingly common, and the result of iritis, much more frequently than the iritis itself, is the complaint for which we are consulted; but I have no doubt that the complete adhesion of the pupil to the lens (exclusion), its occlusion, white patches in the choroid, and other ill events of iritis could be prevented if the patients applied early and attended regularly, if belladonna was always used and mercury given sufficiently.

My paper will throughout appear to have a double bearing as it refers to the two cases in which either the pupil is bound to the lens or cornea, or to a false membrane in its area, but they are alike and are here always considered together in that, for either of them it is required to *free the pupil*.

1. As to the *prevention* of pupillary adhesions I have no other suggestion but that the old belief in belladonna and mercury should be cherished, that the former should never be neglected at any time in the treatment of iritis, and the latter should be generally administered in very frequent small doses continued for some time after the disappearance

tion of *posterior* adhesions or the removal of membranes in the pupil excepting to facilitate the extraction of cataract, as the plan was even in the last century. Lawrence (who has given so much attention to the subject of syphilitic iritis and its results) says of *synechia anterior* and *posterior* that they "cannot be remedied by operation."

of inflammation, with good food and perhaps some iron or other tonic, as well as the specific medicine. At the conclusion of the treatment of a case of iritis the absence of any adhesion should be ascertained, if the iris is not perfectly active, it may be because of a single band between it and the lens; and if at this time the atropine will not cause its separation, it is certainly, in my opinion, to be divided.

2. Until I commenced freeing the pupil in so many of the cases in which it is bound, I believe adhesions were disregarded, as far as any surgical or other remedial attempt is concerned, in any less serious cases than those of virtual blindness, that is to say, that unless there was very extensive posterior adhesion, the pupil was closed, or so in effect, the adhesions were allowed as of course. If belladonna was applied it was for the purpose of discovering an interval of the adhesions for the contemplated artificial pupil, whereby the iris was to be torn, cut, or excised, the adhesions themselves being left, and a confessedly ill-placed pupil made by one of the old methods. Belladonna will in fact seldom effect the severance of pupil-adhesions, when a patient applies because of them, and not for the efficient inflammation, then no longer existing; it may do so, it should be tried, and the discovery of an interval of non-adhesion of the pupil is to me of as great importance for the operation on the membrane which obstructs the pupil as it is for making an artificial pupil, in these cases the most urgently requiring an operation, or in any case for corelysis. The new method can, therefore, be only compared with Corectenia, Corotomia, Corectomia, and some others, all of which are really operations on the iris, not like Corelysis on that which confines the pupil, or occupies its place. These adhesions then have been permitted, but if all useful vision is lost in any case, the iris has been cut through or a part of it removed* and an

* I am not alluding to iridectomy but to the old cases in which artificial pupil has been made in a "sound eye." There is hardly any connexion between iridectomy and corelysis: excision of a portion of iris is a much more urgent and frequent requirement than the detachment of the pupil from

artificial pupil, necessarily out of the axis of vision, has been formed; these pupils are certainly not the best that could be imagined, and the operations on the iris, supposing them unnecessary in these cases, are also, it now seems to me, too severe, but for those of them in which the lens capsule certainly cannot be cleared in the area of the pupil. If, for the sake of conservative surgery, the iris should not even always be operated on for oclusion of the pupil, there has been introduced an heroic operation, which I believe to be quite unjustifiable, for the deliberate extraction of the transparent lens in these cases;* if, by corelysis, a cataract is discovered, it can be removed by way of the restored pupil, but I believe the lens is seldom opaque in cases of oclusion, and I know that although adhesions may exist between the false membrane occluding the pupil, and the lens-capsule, with which it is in apposition, they are probably only partial and much weaker than the capsule itself, at any rate in the cases presenting the external appearances to which I shall allude.

3. When corelysis, instead of doing nothing operative or making an artificial pupil, seems to be the alternative, it is because the ordinary medicinal agents used to prevent the adhesions or for their detachment, have been ineffectual; mereury has been tried, and no ciliary redness or other signs of latent inflammation exist, still the tentative use of belladonna may be made in any case; although it has probably been tried, and that when the adhesions, more recently

posterior adhesions,—iridectomy is for total posterior synechia, exclusion of the pupil, whereas only less extensive adhesions seem to be successfully detached from the lens by corelysis; iridectomy is also for oclusion of the pupil, but corelysis is only possible for those less common cases of this kind in which the membrane filling the pupil is not closely connected with the lens-capsule; iridectomy is a remedy for various morbid processes, but corelysis is only for the recovery of the healthy state of the pupil when no other morbid condition is known to exist.

* Before this was done, and quite lately, the operation of solution by drilling or otherwise has been selected and commonly used, although the lens is transparent; if it is not so, or if the membrane in the pupil is closely bound to the lens, the case is quite unlike those to which, as it may concern *my* operation, I have been alluding.

established, would be much more likely to give way. I do not know for certain how recent must be the adhesions, which, by the use of belladonna, will give way, which will be thus separated, or on what other conditions of treatment, or the state of the patient's health, this will depend; old bands will be extended by its use, if they are narrow and isolated, and recent adhesions, *only, as far as I know*, may entirely disappear. (It is a common mistake to suppose that of course adhesions found to exist with iritis, have resulted from the present inflammation of the iris). When the adhesions are to a false membrane in the area of the pupil, I believe, this membrane, however slight it may be, can only be dispersed by corelysis; no medicinal agent will remove it if it exists after the inflammation has ended.

4. Atropine, or, applied to the skin, belladonna rubbed down with glycerine, should be used without delay in the cases, whether recent or determined, in which the pupil may be or has been involved; if employed when the pupil can dilate fully the iris is so removed from the lens that it can hardly become bound to it by the opposite effect of the iritis, and then lymph having been effused between them, the mydriatic effect will, perhaps, be enough to cause their separation, and if not, the patient's vision is thereby probably improved for a time, and it is altogether essential to the surgeon for an exact knowledge of the state of the case. It is most important that the agent should be repeatedly employed; a solution of a quarter of a grain of sulphate of atropia to an ounce of water, will produce full dilatation in a healthy eye (but, in iritis, past or present, the effect is varied in the different cases), a strong atropine solution cannot cause more dilatation than this, but by it the effect is brought about more rapidly, it also probably lasts longer, and, when the iris is inflamed, perhaps it is the best to be employed (a shade worn by the patient may promote the dilatation or its continuance); and if these means have been ineffectual they should be persevered in, whilst inflammation exists, because the treatment otherwise adopted may give an opportunity of

dilatation in time, but if there is no inflammation they may be hopelessly discontinued. That posterior adhesions not unfrequently become detached is proved by the ophthalmoscopic examinations, in which, with a pupil properly dilated, their remains are seen often as a circle of irregular pigmented dots, or one or two opposite the margin of the pupil when it has been contracted, these, and, after corelysis, the like dots are compatible with very good vision.

5. The basis of the new method of operating is expressed in the title first applied to it of "reinstating the pupil," it is founded on the wish to restore the normal state of the parts, to imitate it better than by artificial pupil, or to improve the vision of those patients with bands of adhesion after iritis, in whose cases they have been left, if not with impaired vision, with probability of a recurrence of the inflammation which had caused them. For this purpose the pupil must be freed, and, if it was practicable, could be only found by the attempt in the different cases in which it is bound. Could the bands of adhesion confining the pupil be broken through by operation without injury of any of the parts concerned, and could the pupil be released from any of the membranes, which after iritis have blocked it up, by their being dispersed by operation; and the natural aperture of the pupil be thus made free again to dilate and contract in any degree? This position I have practically endeavoured to take affirmatively, and now I hold it so. That *synechiæ* are very prejudicial to the future integrity of the eye is my own conviction, but this can add little to the testimony of those who have so much experienced authority; of posterior adhesion, Von Graefe has said "*that the principal cause of the recurrence of iritis is the existence of synechiæ, especially when broad and inextensible.*"* Adhesions not only may

* *Vide* v. Graefe on Iridectomy in Iritis, etc., (translated), New Sydenham Society, Vol. V. In the same article later he has said, that the formation of an artificial pupil prevents the injurious action of the remaining adhesions; but when corelysis will destroy *adhesions* and then their *injurious action*, an *artificial pupil* certainly need not be made. Of my vagrant out-

induce a second iritis, but when the iris is first inflamed they may protract the recovery indefinitely: a single point of adhesion may do this, as in a case of mine in May, 1859, in which, with mild mercurials a syphilitic iritis had ended in resolution, with no ill result but a single point of adhesion to the lens, all redness of the globe had therefore disappeared, but opposite this one band it remained exactly there, and there only for a long time afterwards.

6. Of the advantages of corelysis, whenever we may consider its possibility instead of making an artificial pupil, I believe the most important to be the optical superiority of a central active pupil, the appearance is also an advantage dependent, in fact, on much the same qualities as those for vision; these better optical qualities which almost alone need be considered being the natural position of the reinstated pupil, and the better recovery of its normal adjustment in size; this power of dilating and contracting being often perfect in cases in which the bands of adhesion have been few and narrow. Of the operation, I must say, in anticipation of the objections of those who believe the lens-capsule is so very easily torn; that in about fifty cases cataract has only once followed, when I have known for certain beforehand that the lens was clear;* this case was one of the earliest on which I have operated, and the first spatula-hook I had had made and then used, was not perfectly rounded or well polished; of other ill results of the operation I say nothing, for I believe, if the cases promise well for the operation and all care is taken in its performance, there will be none or that none have resulted that do not more frequently occur when the iris is operated on for an artificial pupil: of this I shall speak again. When I call the operation trifling I do not mean that it is so to the operator, for him, I believe, it

patients none are so constantly at the hospital with various irregular complaints as the cases of pupillary adhesions; the eye is irritable, with or without ciliary redness, and vision defective, as to focus, and in other ways.

* My corelysis operations are yet most numerous, though my colleagues have made some trial of it.

requires much consideration beforehand to determine upon its adoption, an examination by daylight and with atropine and the ophthalmoscope, the latter to decide if any space seeming clear is really unobstructed, or if occlusion seeming complete, really has no space left for the instrument to be admitted. Besides this perfect knowledge of the state of the parts, and so of what can be done, it requires the closest attention on the part of the surgeon, during the operation, to the exact place of the lens, and above all things that the end of the instrument introduced through the membrane or beneath the bands of adhesion should be then at once carried away from the lens and kept always forward. Lastly, of the advantages of corelysis, I must remark, that when other apertures of the body are obstructed by disease, we do not think of making a false passage or a counter-opening if it can be avoided; and if corelysis is impracticable or unsuccessful, still as before, we can make an *artificial* pupil.

7. Corelysis should certainly not be attempted until the ciliary redness and other signs of inflammation are past; I do not propose it as a cure for iritis, though it may divert its return. The inquiry should be always first made before operating, if the lens is transparent or not; this, in the case of an occluded pupil, can only be learnt by the probabilities connected with the amount of vision left, but, of course, if the pupil is only limited by bands of adhesion, atropine and the ophthalmoscope will go to prove an uncertain case.* If the depth of the eye can be examined, it is well for a favourable conclusion of the case to know also that there is no cognizable vitreous disease or white patches in the choroid, etc. If, with adhesions of the pupil to the lens, cornea, or a false

* I remember one case with a clear lens, however, in which some slight filmy bands confining the pupil to it were made apparent by atropine, but with the light of the ophthalmoscope they could no longer be seen, as they were thus illuminated behind as well as before, and were not opaque as usual: these adhesions by daylight seemed pale and flattened: I did not consider them as remains of the pupillary membrane in this case, for besides other reasons, their attachment to the iris was at its pupillary margin.

membrane, I have known the lens to be opaque (corelysis, *for its own sake*, is out of the question), I have proceeded to operate for the cataract, then always using atropine; if by *extraction*, the corneal section is made very readily, and without need of the chief ordinary precautions, then, and especially at its completion, necessary: a membrane filling the pupil may be opened out with one or two needles to make a way for the lens, as the common practice has been; or if separate points of adhesion of the pupillary margin exist, I have preferred my spatula-hook for their detachment (see the footnote to paragraph 12). If it is to be done by *solution*: in the case of a false membrane, I have used the fine needle or needles to open out the membrane (without enlarging the pupil), and then to the cataract itself; or in the case of bands partially confining the pupil, I have introduced the needle where they can be most conveniently reached, and with it broken them through as a preliminary step: two needles may in such a case be well used if bands of adhesion at opposite sides of the pupil are to be reached. The needle operation for the cataract with iris-adhesions, and subsequent *linear-extraction*, may be well adopted if, as is often the case, the patient is young, and the inflammation has not been allowed to proceed to more serious injury than the limiting of the pupil. The patients are not so old as most of those who require an operation for cataract, so that "division" of the lens will have this advantage, and linear-extraction afterwards, if the pupil is large enough to allow of it, will curtail the task that by the sound eye may be better performed. This "extraction through a closed pupil" by a small or large section, however, is hardly connected with the subject of corelysis but as a supplement to the latter operation when it has revealed a cataract not before known or believed to exist; indeed it is especially applicable to some cases in which corelysis, *for itself*, as I have mentioned, should not be attempted, those in which a cataract is known to exist, or the occluding membrane is quite opaque and far back in the contracted pupil, etc.; and corelysis, as I wish it understood,

is for those cases in which the disease of the pupil is the only serious morbid affection that exists.

8. I have operated for the freeing of the pupil in so many and various cases that I anticipate the question, why corelysis should be so often performed, by a few remarks. In the first place, my unsuccessful cases, those in which the pupil always remained bound or occluded, were placed in no worse position than before for excision of a piece of iris, and this I have afterwards done in these cases with success: I have said that cataracts have not resulted, or seldom any worse results than re-adhesions. Next, although I have hitherto been operating in very different cases, wanting experience, many of the patients have been fitted for any occupation; and again, if adhesions did not predispose to a recurrence of iritis, the inflammation is undoubtedly often recurrent, and if a single band is left, the iris, when afterwards attacked, cannot retreat from the lens, and so probably becomes altogether bound to it. For these and other reasons before-mentioned, I always wish to free the pupil from any one iritic band when no inflammation is in existence; and this also I have done, and in so doing I have felt justified, because although when a single adhesion exists, or there are few and narrow bands, the present injury is every way so much less, and the prospect of a return of the inflammation is equally lessened, so that it may be thought both should be ignored in so trifling a derangement of the pupil; none of the unsatisfactory results connected with corelysis I have related have ever occurred in these cases, and these minor adhesions are at once and most easily detached.

9. It cannot yet be certainly defined in what cases the pupil may be reinstated, or in what others it cannot be done, or an artificial pupil must be made, but a close discrimination will show some cases that corelysis certainly will not remedy, besides those in which an eccentric pupil is desirable. The first kind to be observed are those cases in which the false membrane, which completely or nearly fills the pupil, is very opaque, and so deep and intimately con-

neeted with the lens-capsule that the iris, evidently bound by it to the lens, would not probably detach the membrane, with it, from the lens-capsule, which would be removed or the membrane be left there instead, and perhaps the iris would be torn and bleed, and the pupil again become closed. Another kind of cases are those in which not only the pupillary margin but some greater part of the iris in its width is bound, as it often is, to a leucomatous speck of the cornea for instance. Atropine will give the diagnosis of these cases, and of those in which the false membrane is closely united to the lens-capsule. Adhesions generally which involve more than the margin of the pupil are not the cases for corelysis, therefore adhesions to the cornea often cannot be detached in this way, besides that in these cases the part of the cornea exposed is probably opaque: the spatula-hook will certainly separate the parts even when a great width of the iris is bound, but only from the margin of the part adherent by laceration of its tissue, causing bleeding and other ill results, with a very irregular pupil, even if it is not closed altogether. Still if an operation in such a case must be done it may be thought best, as the bleeding and other ill results are as likely to follow any old operation for artificial pupil, to separate the iris at the part adherent:* in the case of broad adhesions to opacities of the cornea, I have been able to do this at once by cutting them through with a broad needle, such as is used for corelysis. Lastly, I doubt if the detachment of adhesions to the lens-capsule, *not to a false membrane*, if they involve nearly the whole circumference of the pupil, is generally successful, insomuch as it *frequently* becomes renewed, and although vision may be improved the pupil is not free. If when I have separated these *very extensive* adhesions the pupil, by the use of atropine, has been able to retreat from the lens, it has been sufficient for the cure; but I have done iridectomy if it seemed unlikely that the pupil would dilate

* This is not corelysis; which implies freeing the *pupil*, the pupillary margin.

when it was freed by corelysis. Von Graefe particularly recommends iridectomy when the *whole* pupillary margin is adherent to the lens, a condition called exelusion of the pupil in contradistinction to its oclusion by a false membrane—the latter being cases in some of which I have found my own plan very successful.

10. The details of corelysis vary very much in the different cases in which it is necessary to free the pupil. The adhesions between the pupil and the lens or cornea, or the false membrane in the pupil, may appear to be slight when they are really very strong, or very elastic with the instrument when they have not seemed so at all under the influence of the belladonna used beforehand. Some bands will appear to offer more resistance* than others of greater extent in the same case, and some wide adhesions that are quite confirmed appear to offer no resistance to the instrument. I am afraid that all these differences are uncertain before the operation, and, in order to retain the aqueous humour when it is done, it must be completed without hesitation.

11. The instruments necessary for corelysis are, besides the spring-speculum and forceps with which to hold the eye, a broad needle, my spatula-hook, and perhaps cannula scissors and forceps. The broad needle should be a small one, only to make an opening large enough, without cutting, to admit the other instruments (this may be proved beforehand with the aperture made by it in a piece of leather), so as to retain the aqueous humour as much as possible. The spatula-hook is figured and described at page 8 of the first volume of this journal: the thickness of the spatula part, “the terminal quarter of an inch,” should be equal, and not much reduced so that it may be very blunt (the instrument, especially at its extremity, and the hook, should be highly polished); the only difference I have

* *More in appearance*: that is to say, the resistance in any case of corelysis is hardly enough to be considered, as it is felt with the instrument that is being used.

made from the instrument figured is that the one I now use is rather less altogether in its width* and every way; the spatula part should, moreover, be wider than the diameter of the round part of the instrument (made so next the handle for facility of turning it "in the corneal wound upwards or downwards"), that when it is in the anterior chamber, the aqueous humour may be better retained. The cannula instruments should be the smallest, and well polished: the scissors should have blunt ends, and the *outer* side of the blade used should be kept next the lens during the operation.

12. Corelysis for bands of adhesion is difficult when they exist at various parts of the circumference of the pupil without any wide interval (see Fig. 2, *M.m.*): if such an interval exists the opening into the anterior chamber should be made at that part of the corneal margin, and the spatula-hook there introduced to detach the bands (*N.n.*); but if there is no large space the bands on the side of the pupil at which the cornea is punctured cannot be satisfactorily reached (as at *a.* and *b.* *M.m.*) without making afterwards another puncture on the opposite side of the cornea, and separating those that could not be severed at first: this, on account of the escape of the aqueous humour, can only be accomplished at once, if it is very quickly done. Sometimes, I have, with the hook of the spatula, secured bands on the side at which the instrument was introduced by pulling them towards the greater circumference of the iris, at the aperture of the corneal margin, as the spatula-hook is removed from the eye; but this manifestly cannot be done if the bands on this side are firm, because the pupillary margin would rather become torn by the force which would be exerted on one part of its circumference, so that, unless the adhesions in any such case are found to give way very readily, I have not attempted the detachment of those on the side of the corneal puncture by any such extension of the pupil, as its safety then would be made to depend on its degree of extensibility. The ope-

* About $\frac{1}{4}$ th of an inch.

ration is also difficult, or rather embarrassing, when the bands to be detached are old and very firm, or long and very elastic; in the former instance, the iris itself is seen to stretch so much that its separation from the ciliary processes seems probable, but instead of this the adhesions will always, in my experience, rather give way: in the latter case, the band will also break through, however elastic it is, though, to effect this, it may be necessary to stretch it with the spatula hook from the pupillary margin almost across the anterior chamber; no other misfortune occurring, in either case, than perhaps a little bleeding from some ruptured vessel of the iris. I used to wonder why adhesions of considerable length did not more frequently hang bowed when the pupil was contracted; but now I believe that, as a rule, their great length, when the pupil is dilated, proves their being very elastic, and when detached at either end, they do not generally hang down loosely, but retire at once, more or less, to their attachments. The narrow bands of adhesion are, in my experience, generally old and elastic. (I have seen one instance in which a long band of posterior adhesion became bent at an angle in the contracted pupil). Corelysis has many more difficulties when the pupil is to be freed from a false membrane; if no aperture exists in it, one must be made: this is described with the account of the operation; and, as in freeing the pupil from bands between it and the lens, the question is always how to reach that part which is on the same side as the corneal puncture.*

* *With a large section of the cornea (lower) for the extraction of cataract* (see paragraph 7) Richter found this difficulty in the separation of adhesions of the iris; he says, "How is it possible to separate the whole surface of the lens from the iris with an instrument which is quite straight? It may be possible to make it pass between them in the upper part of the eye, but it will be found impracticable in the under; and what is there to be done if the adhesion be chiefly at the inferior part? The instrument I generally make use of is a flat probe, pretty much bent at one end. This I introduce between the lens and iris, and endeavour to move it gradually around its axis, sometimes gently pressing on the cataract in order to push it a little back, and promote the separation."—From "A Treatise on the Extraction of the Cataract." (Translation). London, 1791.

13. Of the dangers of corelysis in anticipation of the operation, especially of causing cataract, I have already spoken, in comparing the reinstated pupil with iris-operations. I do not know how severe an injury of the lens-capsule is necessary to produce a cataract, but I am sure with instruments well made for the purpose I frequently touch it without any ill result; but, as I have said, I always keep the end of the instrument rather forward; that is to say, against the posterior surface of the iris or pupillary exudation, in detaching bands or a false membrane, that I may touch the lens as lightly as possible. I should not be so careful in this matter but for the difficulty of perceiving the minute distance between the iris and the lens, and of appreciating the slight changes of place which would bring the instrument upon the lens; so that, during corelysis, I constantly bear in mind to keep the end of my instrument away from the lens. I have, at the present time, a case at Moorfields in which the lens would, according to the common notion, have been expected to be changed from its transparency.

John Bryson, aged 52, a smith, had grains of gunpowder in different parts of the skin of the face, and a great many in the conjunctiva, and at different depths in the cornea. When twelve years old he was using an old gun, which burst, and his face was quite blackened with the powder, but twenty-three years afterwards he had small-pox, and the black marks in the skin were nearly all removed: some of those left in the conjunctiva and cornea were as large as a mustard seed. For seventeen days after the explosion he could see nothing (? edema), he had nothing done, his vision was for a year or more confused, he had double vision with the right eye when the left was closed, but afterwards he knew he could see well again, because he could in his work, with either eye, "look along a *straight edge*," as he was in the habit of doing. He had had no pain in either eye, and this was so until three years ago, when he had ague, and the right eye became impaired, but he did not know it was so dim until he got one day a "fire" (a drop of dross from the surface of welding-hot iron) in the left eye (which was sound); he put his hand to it, and found he could only see light with the other eye. There was an almost complete "areus" in both eyes, and there were in both several large and small black bodies, some just beneath the conjunctiva, some deeply imbedded in the sclerotic and cornea, besides many cicatricial specks in the latter; all of these were in greatest number in the right eye, with it he could only see large light objects, but with the left eye he could, with his

spectacles, read the smallest type. Atropine and the ophthalmoscope showed, in the right eye, many specks of opacity in the cornea, two of them with black centres, irregular striæ, chiefly in the centre of the lens and at its lower part, and large brown flakes moving occasionally in the vitreous space with the movements of the globe: the retina and choroid, as well as they could be seen, were normal: in the left eye there were the same specks in the cornea, but none with black centres: there was no other morbid appearance in any part of this eye; but in the anterior surface of the lens, near the upper and inner margin of the pupil, there was a dark body seen sticking into it, and partly covered by a greyish opaque speck, projecting a little: it exactly resembled the other powder grains, but was half hidden by lymph (?): no radiating or other opacity around it, or in any part of the lens, existed: the depth of this eye also was clear and normal. I extracted the lens of the right eye, and with as good a result as could be expected, considering the state of the cornea and vitreous humour, before the operation; with it he could afterwards distinguish large type.

Any other danger in corelysis that I know of, is much greater in the operations for artificial pupil; for instance, bleeding almost necessarily follows when the iris is cut or torn for these operations; but in freeing the pupil it is not common, although, even in detaching bands, I have known it occur from the part detached, or, when they are very tough and stretched, from the surface of the iris: it is very much to be avoided; and, when it occurs, the blood, if it is much, should be evacuated with the scoop: it is best, at any rate, to attempt this, for if a clot has no other ill result and is rapidly absorbed it will interfere with the *immediate* advantage to be expected by successful corelysis, and perhaps its consequence is greater in the result, even if it is not a failure, than may be supposed. Sometimes, I have found, when the pupil has been freed, and it has filled with blood, the operation has resulted in its closure, as I have thought, perhaps with the organized remains of the clot in the pupil, or by a membrane so discoloured by it, or pigmented, that at first sight, without the ophthalmoscope, the pupil seems to be clear. I have suggested one rule in corelysis which will rather encourage bleeding from the iris, unless it is well considered: when the pupil is freed from posterior bands confining it, the spatula-hook introduced between the iris

and the lens is to be carried forwards, *but not very much*, as it is brought up to the adhesion, or it may be torn through in the iris at the pupillary margin, or at that part of it, instead of near the lens, where it will be unlikely to cause bleeding: again, when the pupil is to be freed from a membrane, not only the lens, but the iris must, as I have said, be discriminated and avoided in opening the membrane with the broad needle, so that, although this instrument in the pupil must be kept carefully forwards, *as much as possible*, it should not be so much so as to endanger the iris, which it is very important not to injure. In no case of corelysis should the pupil be extended with the spatula-hook, or other instrument, in any direction more than is absolutely necessary, because, by the stretching, some of the small vessels of the iris, which has been (perhaps recently) inflamed, are likely to give way and bleed, the more so as the aqueous humour has escaped, and later ill-results may follow this forcible dilatation of the pupil. The cold water, and perhaps the atropine, used after corelysis will check the bleeding: they should be applied at once.

14. My method of operating is the following: atropine has been applied to the eye: the patient is recumbent, and I stand behind him: I have chosen a broad needle which is suitable to the spatula-hook, that is, as I have explained, a little wider than it: the patient has probably taken chloroform. I secure with toothed forceps, in the right or left hand, as it may be most convenient, a fold of the conjunctiva close to the corneal margin on the side opposite to that at which the puncture is to be made, thus I draw the eye sufficiently in the desired direction and steady it. (It is best to secure a considerable fold of the conjunctiva close to the cornea, and to have a deep hold of it that it shall not give way: sometimes it is convenient not only to draw the eye with the forceps in an opposite direction to the proposed corneal puncture, but at the same time to rotate the globe somewhat on its antero-posterior axis: this may be done either way by having the conjunctival fold a little to one or

other side of the direction in which the globe is to be drawn.) It is impossible, in the variety of cases in which corelysis is applicable, to say generally which way the globe is to be held, because, for instance, if an adhesion of the pupil is most conveniently to be reached from above it may be detached without any rotation of the globe, if it is so prominent that the brow will not interfere; or in another case the reflection from the cornea of the light of the window opposite the patient may make some rotation of the globe, when it is held with the forceps, more convenient than a change of place on the part of the operator. It is also impossible to say where the puncture should be made in the cornea, even at what distance it should be from the margin: this is, in each case, very important, for, when made, the corneal opening is a fixed point from which alone the operation has to be carried on to its completion. I have not generally made it very near to the margin (perhaps at a line from it), but my rule will be found by considering first, that a (posterior) adhesion should be always detached as close to the lens as possible; second and third (in this special instance), is the band corresponding to the position of the pupil when contracted or dilated? and so at what part is it of the convexity of the lens? of which the natural curve is to be

a. A posterior adhesion of the *contracted* pupil.

b. The same, of the pupil when it has been less contracted.

c. The normal iris.

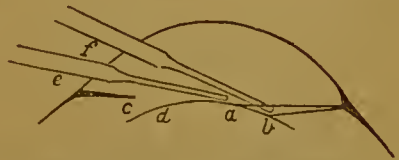
d. The lens.

e. The spatula-hook introduced through the cornea in the best position to detach an adhesion at *a*.

f. The same, to detach an adhesion at *b*.

The figure is intended to show that to detach adhesion *b*, the spatula-hook must not be introduced so near to the margin of the cornea (seen in section) as at *e*, or the adhesion cannot be reached, *at the point of its attachment, without pressing upon the lens*.

Fig. 1.



considered (Fig. 1), as it should not be pressed upon by the instrument as it passes over it to reach the band at its point

of attachment, the severance of which alone is to be attained; on the other hand, it can never be required to make the puncture far from the corneal margin, or the end of the straight instrument might come upon the lens, which it would be much more likely to injure than the flat side of the spatula would.

15. The easiest case of pupil-adhesion to be detached is when a single band connects the pupil with the lens, then the corneal puncture may be made most conveniently, perhaps (as in Fig. 2, *M. n.*) not exactly on the opposite side to that at which it is, or at a quarter of the circumference of the cornea, but between the two, that the spatula-hook may be advantageously used as a spatula or as a hook; as a spatula, that is to say, for its blunt edge, the instrument is most generally useful, and perhaps most safely or easily used, as the stretching of the iris that may occur, is thus more distributed than by collecting some part of the width of the iris, to which the band is adherent, in the hook to be severed at once. With the instrument entered in the direction I have described, the band, if it does not detach before the blunt edge, will pass downwards with the sloping direction of the instrument, and be arrested by the hook, with which it can be then broken through. If two such bands exist at opposite points of the pupil (of an hour-glass shape as in the old case referred to at page 9, of Vol. I.) the spatula-hook will be most conveniently used when entered from a part of the cornea, towards its margin, midway between them (see Fig. 2, *N. m.*), and then, if the hook of the spatula is required for their detachment, the instrument must be semi-rotated when the first one is separated, before the instrument is applied to the second band. When the instrument is thus rotated in the anterior chamber (the aqueous humour should not have escaped and) the end of it should be brought forward towards the central part of the cornea, that as the blunt edge instead of the flat side of the instrument passes the lens, it may only touch it lightly, if at all. If many

Fig. 2. The four diagrams show (magnified) various posterior adhesions of the pupils, all under the influence of atropine.

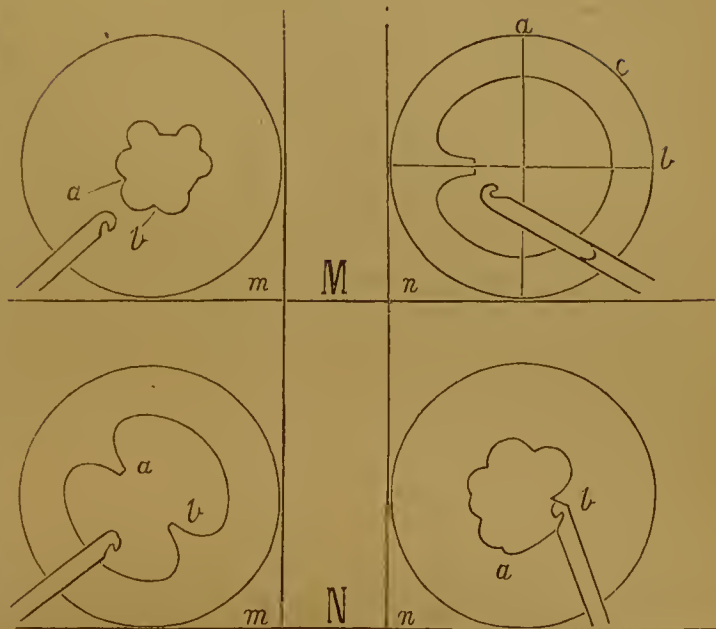
M. m. The six points of attachment, nearly equidistant, are so much the more difficult: the two, *a* and *b*, cannot be easily detached with the spatula-hook introduced through the corneal margin thus most conveniently for the others.

M. n. The instrument, to reach the point of adhesion, is best entered where it is (or at *c*) and not at *a* or at *b*.

N. m. The spatula-hook should be brought up to the two opposite adhesions (*a* and *b*) from a point midway between them.

N. n. With such various adhesions the instrument is used to most advantage at the widest interval (between *a* and *b*) and can be passed (as it is shown at *b*) even behind those on the same side as the corneal opening.

Fig. 2.



bands exist the instrument is introduced to most advantage from the side at which there is the greatest interval for its admission (see Fig. 2, *N. n.*), the division of pupil attachments being always attainable excepting on the side at which the instrument is being used (see Fig. 2, *M. m.*). The broad needle to make the opening in the cornea, is directed towards the pupil, and is introduced with a thrust, without cutting, as far as the widest part of its blade, to which its size in relation to the spatula-hook has been calculated beforehand; it is then quickly withdrawn, and the spatula-hook as quickly passed in by the opening that is made, the hook being on the upper or lower edge as may be required, the end of the instrument is brought up to the adhesion and passed under the margin of the pupil (as at *b*, in Fig. 2, *N. n.*)

close to it and far enough beneath the iris, the end of the spatula being at the same time kept in apposition with it, the instrument is then brought towards the pupil, up to the adhesion, not pressing the iris forwards or the lens backwards, but just between them, that the attachment may be released, as it generally will be very readily at its place, without tearing the iris or compressing the lens; in all this it must be remembered that the lens is not felt in its position, the direction of the spatula-hook is a matter of calculation throughout, the course it is to take has been determined and is well known; and the iris or its pupillary adhesions will offer no appreciable resistance. If all the cautions, respecting the lens, I have given appear contrary to what I have said of the unnecessary fear commonly entertained of its being wounded, I can only say, that by taking such care I have had the success which induces me so confidently to ask attention to the new proceeding, and I do not know that cataract would have resulted from less caretaking. The withdrawal of the spatula-hook should be, of course, with the flat part in the direction of the length of the corneal puncture, and it is effected without any chance of the hook being caught in the cornea, if the edge of the spatula, *without the hook*, is kept lightly pressed into the corresponding extremity of the linear wound.

16. The most important cases for corelysis remain to be considered: I have known vision more impaired with bands confining the pupil to the lens, than with a false membrane, leaving to all appearance in the pupil no free space whatever; the case of simple bands of posterior adhesion with very imperfect vision, may be possibly explained by various complications of the iritis, which has caused the adhesions limiting, but not blocking up the pupil; and the other case in which a complete false membrane filling the pupil exists with fair vision, by its being only a very fine network, thinnest at its centre, in the pupillary area: these false membranes generally have been recognized as surgical (artificial pupil) cases, but only to be operated on when

serious loss of vision is the patient's complaint. The occluded pupils which I am about to consider, in an operative relation, are also most important, inasmuch as they are most difficult, and as they are certainly irremediable but by operation. Here I will premise that it seems to depend very much on the diagnosis of the false membrane, if corelysis can effect a cure when the pupil is filled: the cases suitable for the operation, are not those in which a perfectly opaque patch in the pupil is seen with an iris, more or less standing forwards around it, the membrane is not of a dead white, but gray by daylight (Plate XI, M.), or half illuminated by the transmitted light of the ophthalmoscope, and it is little behind the iris, which does not fall back towards it, or is not bulged around it, and is not discoloured: the condition I allude to, in which the iris is in its natural place, and the membrane filling the pupil is about on a level with it (which with its partial transparency are, I believe, the indications for corelysis, in cases of occlusion), is probably to be explained by two circumstances in which it differs from the opaque membranes with prominent iris, the closed communication between the anterior and posterior chambers not being altogether impervious to the aqueous humour, and the membrane not being firmly attached behind to the lens-capsule, so that there, as it is not closely adherent, some fluid transition is allowed. Indications favourable to the operation, are the evident contraction of the fibres of the iris when the eye is exposed to a strong light, a large anterior chamber and the (occluded) pupil not very small, improvement of vision, so as to read large type, by the use of atropine,* etc. My best results have been, I think, in cases of young persons who have been judiciously treated for a first attack of syphilitic iritis, and to whom some mercury

* In any case, for corelysis, I should expect the patient to have a ready appreciation of light-reflecting objects, unless there is a cataract behind the membrane, which may be distinguished from the opaque white membrane filling the pupil, which it is impracticable to corelyse, by the opacity in the latter case being more distinctly seen as it is more in front.

has been already given. If the false membrane seems altogether to occupy the pupil, it must be examined with atropine and the ophthalmoscope, for the discovery of any possible gap in it, by which the spatula-hook may be introduced, a chink even smaller than the end of the instrument may be made to admit it, and the membrane is torn through with the hook of the spatula, or divided with the cannula seissors. If the hook of the spatula is to be used, the instrument must be introduced through the cornea, on the *opposite* side to that at which the opening is in the membrane, and in this way I have generally concluded the operation at once: the cannula-seissors can only be used when introduced from the *same* side of the cornea as the opening in the membrane, and probably, only with safety after the spatula has been passed between the membrane and the lens; this method, therefore, I have not followed since the case of Sharp, I have referred to.* When no space at all is left in the occluding membrane, the plan I have adopted is to introduce the broad needle through the cornea, in any direction which may appear to be lengthwise of the membrane, then to advance the needle across the pupil to the opposite side of the membrane, and transfix it just within the pupil close to the iris, but carefully not to cause bleeding from it, raising the membrane from the lens with the needle as soon as the point has pierced it, and advancing the needle a little to make the opening larger, whereby there is no greater fear of wounding any part, as the needle has been passed *across* the pupil, and the convexity of the lens, and beneath the iris. Because of the spherical prominence of the lens which is close behind the pupil, it is clearly impossible with safety to pierce the membrane with the needle on the same side as that

* At the commencement of this paper: in his case I introduced the cannula-seissors, by a previous puncture of the cornea with the broad-needle (see Vol. i, p. 6); but now cannula-seissors are made to be passed in without this preliminary, thus better retaining the aqueous humour; and if one point only was made sharp for this purpose, the other one might be used for corelysis safely, being kept next to the lens.

by which it is passed through the cornea, but I not know whether it would be safe in any case, and the pupil could be cleared by passing the cannula scissors at once through the cornea, and the blunt point through the crevice, *when there is one*, in an occluding membrane, without previously using the spatula to lift the membrane and separate it from the lens, by all which the aqueous humour is so much let escape, that as in Sharp's case, the scissors could only be adopted at a subsequent operation, which, of course, it is very desirable to avoid: I passed the spatula-hook once through the membrane and close behind it, to separate any filaments that might connect it with the lens, but I did not venture, at that time, to use the scissors, because of the diminution of the anterior chamber which had then resulted. I am inclined to the adoption of my early plan, of passing the spatula *between* the lens and the membrane, *before* the latter is operated on, in every case.

17. As to the after-treatment of a case in which the pupil has been freed, I have no special knowledge; I have had atropine applied after the operation night and morning,* the eyelids closed, to insure rest to the eye, perhaps with a bandage and cold water at first, with a folded rag constantly until any ciliary redness has faded, or it is no longer agreeable to the patient. I have never known any more extensive inflammation than of the iris itself, follow corelysis: in several cases, by this consequent iritis, the pupil has again become occluded or bound to the lens by adhesions, and then no benefit has resulted: in two or three, the pupil has been more obstructed than it was before the operation; and if it is not, at once, subject to treatment, this traumatic iritis is fatal to the operation and altogether hopeless: leeches and other antiphlogistic treatment are the means I have employed for its reduction. A rather common accident when the pupil has had many posterior adhesions, is their immediate reformation, even when well detached, this has occurred, I think,

* And for some weeks after the operation it is probably advisable to continue the mydriatic treatment.

in the cases in which the iris has by their extent and duration, or by change in its tissue, been long inactive, and the atropine (which seems to have little effect when applied to an eye reddened by a recent operation)* has not withdrawn it from its apposition with the lens ; after this, I have sometimes repeated the operation with success, or I have performed irideetomy. Corneal adhesions are, in any case otherwise suitable for corelysis, so far anterior to the plane of the iris that they are very unlikely to reunite, because *all* the aqueous humour seldom escapes in the operation, and if it has, in any case, and the iris and cornea after detachment, can be in apposition, it is very soon resecreted and retained.

18. Of the results of corelysis, I can say generally, that the more the pupil recovers its activity the better it is in every way : sometimes the iris seems to be so condensed by the original inflammation that, after detachment of bands or more probably of a membrane, although well effected, the pupil must always have a uniform shape and little variation in size : vision may nevertheless be much improved, and even if it is not, the result of freeing the pupil cannot be said to be negative, as we know the relation of iris-adhesions and recurrent iritis. I have sometimes thought of dividing the pupillary margin, with cannula-scissors in these cases, in which the pupil is freed, but seems to be so very small an aperture, of one size, contracted by the infiltration of old inflammatory exudation ;† this operation would enlarge the pupil if it were desirable, but if it acted again, it could only

* Sometimes, therefore, I have applied belladonna rubbed down with glycerine around the eye.

† Are there not some cases of old myosis in watchmakers and others, who can see very well with the most brilliant illumination, and less and less well in diminishing light, who would be benefited by simple division of the pupillary margin of their irides with cannula-scissors, as sphincters guarding other apertures of the body that may be abnormally contracted are incised occasionally ? A central circular pupil is best optically and cosmetically, but the artificial coloboma iridis should not be extensive, and only made when myotic eyes are not otherwise diseased, than as the iris is affected ; many cases of congenital coloboma, even in the (common) downward direction, co-exist with good vision.

be by dilatation at one part of its circumference. As to the shape of the pupil after it has been freed from an adhesion, the part at which it was connected frequently remains immoveable, but as a whole, that is to say, it is moved freely but it has a point of its own (out of the centre of the pupil, nearer to the pupillary margin, and always equidistant from it), to which so many of the iris-fibres are directed, and which is only made to change its place by the dilatation and contraction of the remainder of the pupil, whilst it contributes nothing to the change of size in the pupil itself (see Fig. 3, A. *b.*); the outline of the circle is generally there somewhat flattened (see Fig. 3, B. *b.*), and the band, especially if it has been in connexion with an old leucomatous speck of the cornea, remains as a slight projection: if, in any of my cases, there has occurred any loss of substance of the pupillary margin, as a circumferential indentation, it seems to be less satisfactory. When, soon after corelysis, the remains of an old adhesion project from the margin of the pupil, backwards or forwards, in the place it had before it was detached, it may appear at first sight, as if the operation had not succeeded, but the projection of either end of a band which has been severed, soon diminishes, and shrinks more and more until the deformity is hardly perceivable (see Fig. 3. A. *a.*).*

I will now conclude this vague rudimentary memoir with a few cases, in which neither the best nor the worst results of my various efforts to free the pupil are shown: they are instructive, encouraging to me, and by-and-bye, I hope to know the precise limits for corelysis operation; and then, with more experience, to write again on this subject.

James Mussel, aged 25, stableman, February 16th, 1860, came to me at Moorfields, and I entered his case as "Occluded pupils; slight corneal nebulae." Three years ago last November he had a chancre, for which he had no medical treatment, and then sore throat and an eruption, for which he took mercury, so as to make his gums rather tender: two or three weeks later his

* *Vide* more "results,"—Ophthalmic Hospital Reports, Vol. i., pp. 42, 93, 142, 204.

eyes inflamed, the left one two or three days before the right: he had only a "thick brown mixture," took no mercury, and for four months they were "bad." When he first came to me the state of the eyes was very symmetrical, both pupils small, irregular, lozenge-shaped, and longest laterally, were quite filled with pearly membranes. There was no ciliary redness, and his eyes were otherwise healthy-looking: he had occasional slight pain in the brows: with either eye he could read well No. 10 (Jaeger's) or a much smaller type with difficulty. The irides would readily dilate and contract a little with light, but atropine showed no part of their margins to be quite free, nor was vision improved by it. With the ophthalmoscope only a faint red light could be seen through the pupils in some ways of the reflection, where the gray membranes were thinnest at their centres: at their margins they were much more dense and opaque with some dark (uveal) streaks near the pupillary margins (see Plate XI. M.). On the 5th of March, I operated alike on both the occluding membranes, with the broad needle introduced at the *outer* margin of the cornea, and its point through the membrane, on the opposite side of the pupil, at the *inner* margin close to the iris; then, the point being a little raised, it was advanced so as to make, with the broader part of the needle, a rather larger opening: next, with the hook of the spatula, passed through the gap in the membrane thus made, the *upper* margin was seized, and torn through by a slight movement, as if to withdraw the instrument: the spatula-hook, being turned the opposite way, was again passed through the opening in the membrane, and at its *lower* part it was by a similar proceeding again torn through, separated from the pupillary margin as I wished, and lifted away from the lens. At this time the membranes were retired to the outer sides of the pupillary apertures, and left there hanging loose towards the lenses: the aqueous humour having all escaped, I could do no more in either eye. The membrane in the left eye had seemed to me the strongest: in the right a minute drop of blood escaped from the iris. I ordered rest, cold water, and a bandage over both eyes. On the 8th, there was very slight redness of either eye: the pupil of the right (in which had been the bleeding from the iris) was again closed with the membrane filling it, and it looked much as before the operation: the left pupil looked quite clear, but, as after the operation, the rolled-back whitish membrane was adherent to the outer side of the pupillary margin, it responded fairly to light, was tolerably round, and still showed indication, being longest horizontally, of its former shape: with it he could read Jaeger's smallest type (No. 1.) without much difficulty, and the patient said with it everything looked as clear as before the first iritis. The ophthalmoscope confirmed this as the true state of the parts. I spoke of removing, with the cannula-forceps, the retracted membrane, and so (surgically) completing the cure; but the patient said his sight was perfect, and would not hear of anything more being done to this eye; and so, as the pupil was unconfined, I was not sorry to think no more of it, and thus it was left permanently, and so it remained (Plate XI. N.). On the 12th, a narrow vertical chink being visible on the inner side of the membrane refilling the pupil of the right eye, I by it reintroduced, from the outer side, the

spatula-hook, and separated it upwards and downwards, but the pupil never became clear or quite free of the old membrane; he saw better however with it than before the operation: the left eye was still good for the very small type. He returned to his employment.

This was a promising case for corelysis, and perhaps no other operation would have been attempted. The result, in the left eye, was very satisfactory. I believe that I operated again upon the right eye too soon after my first attempt, and that the bleeding from the iris prohibited a good result. He has not returned to the Hospital.

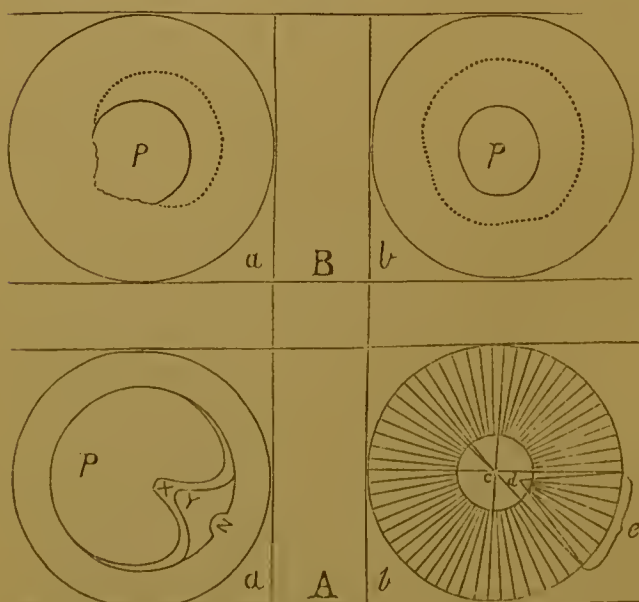
Frederick Marsh, aged 55, came to me on January 19th, 1860, complaining of floating black spots and impaired vision: with the right or left eye he could only read Jaeger's largest type (No. 20); both pupils were bound to the lens at many different parts of their circumference, they were rather small, irregular, and acted very little, if at all. Sixteen years previously he had had "rheumatic fever" and "inflamed eyes," he was "subject to rheumatism;" but, not until he had an attack four months before this time, were his eyes more affected than they had been since the fever: his sight had become much worse, but he saw less of the *muscæ* than before. The iritic bands were adherent so nearly to the centres of the lenses that with atropine and the ophthalmoscope, I could ascertain no more than that the lenses, in the axis of vision, were not cataractous, the bands connecting the pupil and the lens were dark coloured; but a broad, irregular, gray band extended across each pupil as an incomplete occluding membrane. I operated at once: in either eye introducing a small broad needle at that side of the corneal margin at which the iris was least drawn towards the centre of the lens, as there I thought the adhesions must be weakest, if not deficient: all the bands, pupillary or pupillo-lenticular, in either eye, were readily detached with the spatula hook which passed around the pupillary margins and by slight extension of the pupils on the side at which I had entered the instrument, where the adhesions seemed to be slight, as I had anticipated, I believe both were perfectly freed. The bands in the right eye offered no appreciable resistance, in the left they were strongest. I ordered atropine drops repeatedly, and cold water constantly to the eyes. On February 6th, the patient, who lived in the country, was recalled to his home, and he was quite satisfied with the improvement effected. Both pupils acted to some extent: both were readherent (to the lens) at some parts, but dilated *fully* in other directions. To ascertain this, I had applied the atropine drops; but, before doing so, I found he could read with the right eye No. 16, and *with the left* No. 2, (of Jaeger's types).

If this patient could have stayed in town I should have operated again to free the pupil of the remaining adhesions; but, left as it was, the case was rather unsatisfactory, although

I believe numerous pupillo-lenticular bands, approaching to "exclusion of the pupil," are the least inviting cases for corelysis, much less than those of simple pupillary (occluding) membranes. This patient, as in many such cases, was so much surprised with the improvement of vision after the operation, that he would not consider any proposal to effect greater good subsequently; and the surgical objection to the result, that the pupils were not freed, seemed to him therefore of no importance.

James Harrington, August 22nd, 1859, came to me at Moorfields for impairment of vision. He had some corneal opacities of the left eye, of which the palpebral conjunctiva was granular (this I treated advantageously with sulphate of copper), but vision was most defective in the right eye, which six years before had been many months inflamed. He complained that everything appeared misty; still he could read with it ordinary type, or tell the time by the clock on the wall of the out-patients' room: the cornea of this eye was not nebulous as the other, or the conjunctiva roughened; but there was, near the centre of the cornea, the scar of an ulcer to which the pupil was adherent by a single band (Fig. 3. A, *a*, *x*): there was also, near the centre, a number of minute brown dots on the back of the cornea (? self-detached adhesions). The existing band, which was on the inner side, opposite to the best portion of cornea, I detached with the spatula-hook at once (Fig. 3, A. *a*. *r*.); and on September 5th, having previously discontinued the atropine, I found

Fig. 3.



B. *a.* and *b.* diagrams of Sarah Brown's case.

a. before the corelysis. *p.* the pupil, which, with atropine, dilated to the extent of the dotted lines.
b. after the operation.

A. *a.* and *b.* diagrams of James Harrington's case.

a. (*p.* the pupil, under atropine). *x.* the adhesion to the cornea, which, as soon as it was detached, retired to *r.* and, after some time, to *z.*

b.-c. the centre of the pupil, to or from which, normally, dilated or contracted, all the iris-fibres seem to tend. *d.* the abnormal, eccentric point to which the fibres *c.* are directed, and which, after the operation, moves with them.

the pupil act well, altogether free from adhesion and circular, with a prominence at its margin, indicating the retracted band (Fig. 3, A. a. z.). His vision was clearer, and he read the smallest type with the eye operated on.

I suppose this ease, considering the obstruction of the dots on the back of the cornea, was as good a restoration as could be. The band was behind the clearest part of the cornea, and dragged the iris forwards on that side, so as to make the pupil oblique, and limit it to the more obscured part of the cornea.

Sarah Brown, aged 30, needlewoman, had had iritis, probably syphilitic. In the right eye she had intermitting dead pain when attending closely to her work or in a strong light: one-third of the pupil at its lower and outer part was bound to the lens (Fig. 3, B. a), the remainder dilated well when shaded or with atropine applied: she had no complaint of her vision. On September 29th, 1859, I detached the adherent part of the pupillary margin with the spatula-hook introduced at the opposite side of the cornea and once passed quickly round under the iris and between it and the lens-capsule. On October 10th, the pupil was all free; its circumference was somewhat flattened at the part which had been adherent; but it was now almost circular and dilated and contracted well, almost equally well, at all parts (Fig. 3, B. b). When she first came she could see well with the eye impaired, but only at short distances, *e. g.*, she could only tell the time by a watch held within ten inches of the eye, but, after corelysis, she could tell it at twenty inches distance. As to one of the chief reasons for which I had operated, the pain, I found she had none of the occasional attacks which had so much hindered her work: she had slight conjunctivitis for some weeks after the operation but when she shaded her eyes from direct light as I recommended, she could go on, as it was necessary in her employment, continuously: she continued to attend for the conjunctivitis, which was followed by obstruction of some of the Meibomian follicles, and when this was remedied and her general health improved, she came no more to the hospital.

This patient could never well describe her symptoms, and the inflamed state of the conjunctiva, and especially of the inner surface of the lids, caused pain *after the operation*, which I thought might be due, in some degree, to the diseased state of that part of the iris I had freed from the lens and therefore I had contemplated excision of so much of it, but hesitated, because her vision was so good, and it would have made so large an aperture in a very unfavour-

able direction downwards: the pupil was perfectly free, there was no ciliary redness or abnormal tension of the globe, and until my care was directed more especially to the lids inflamed with accumulations in their follicles, I had tried to explain the pain remaining, by the imperfect contraction of the pupil (which, though free from adhesion, was lymph-bound) in attention to her work: the pupil, in this case, having become adherent when half dilated, not quite contracted, as in most instances.

Martha Lane, aged 14, December 5th, 1859, "Leucoma, with anterior synechia of both eyes:" this had been so since infancy: the corneal opacities were small and placed a little to the lower and outer side of the axis of vision of either eye: there was also a symmetrical adhesion to them of the pupils, which, when they were contracted, were thus brought forwards close behind the specks, and so she saw very little: the left corneal patch was the largest but least opaque, and with this eye her vision was most defective, hardly enabling her to tell the time. The adhesions were minute points at which the irides could not retire from the cornea. I detached both, they were very elastic and would hardly give way in the hook of the spatula but with a slight rotation of the instrument in the anterior chamber: the pupils were perfectly freed as the after-operation proved, but the appearance was very deceptive, as the pupillary tags floated up and projected forwards at their places as the iris there had done for so many years. Vision was much improved, for instance, with the worst (left) eye she could read small print under favourable circumstances. On February 6th, 1860, she came again to the hospital: the eyes were in the state I had left them: there was no iritis or any adhesions but the old corneal opacities interfered with vision when the pupils were contracted, and she hoped her sight might be yet more benefited. I did iridectomy alike in each eye downwards and a little inwards: that is, most in the downward direction, away from the opaque parts of the cornea. On March 12th, I found her (elongated) pupils were equal in size, symmetrical, and unobstructed: her vision was again improved, but the left least so, now because two minute hazy specks are made visible in the cornea, to the lower and inner part of it, before the pupil made by the iridectomy-operation.

This case shows how corelysis may precede operations for other diseases, besides cataract. In the case last but one quoted, I contemplated iridectomy after corelysis and in this, iridectomy, in so favourable a direction, could not have been done, if I had not first detached the pupillary adhesions.

Charlotte Davis, aged 22, came to the Hospital October 13th, 1859. When two years old she ran a scissor-blade into her right eye: her mother

did not know what she could see after this accident, and the vision she had of this eye had been of little or no use to her as long as she can remember. The eye was of normal tension, etc., but the pupil was a small narrow chink of an horizontally-placed hour-glass shape, so confined by two points of adhesion, one at the upper margin of the pupil to a minute speck near the centre of the cornea, and the other at the pupillary lower margin to the centre of the lens-capsule; thus the distorted pupil was confined and dragged very much forwards above to a prominent cornea, and at the lower part very much backwards to a capsule which had retreated, the lens itself having been removed by solution-operation of the accident-time.

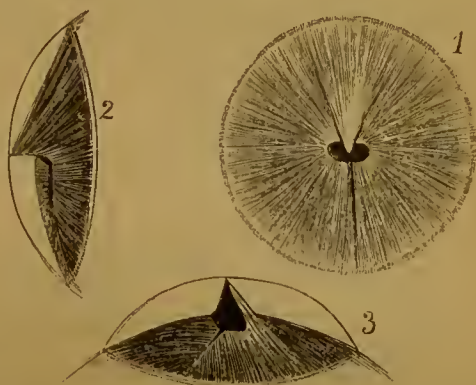
(1. The *front view* of the iris and pupil.

2. The *side-view* of the same.

3. The same *seen from below*.)

The remains of the lens and lens-capsule were little opaque; the pupil was of course larger the more it was viewed from below; and, with this eye, she could see large objects, but only then, as might be expected, their shapes in a good light, and when held very much downwards, whereby she

Fig. 4.



could look under the anterior synechia, which was the upper one, and over the posterior synechia, which was at the lower part of the pupil. I, with all the operative preliminaries, passed the spatula-hook through the pupil, around the posterior adhesion at its outer side to detach it, but it was so elastic and the remains of lens-capsule, to which it was attached, was so moveable *with* it, that, not having done it, before the aqueous humour had all escaped, I desisted. On the 20th, I again entered the broad needle at the corneal margin, and, with it, divided the anterior adhesion: some bright blood immediately flowed down over the iris and became lodged at the bottom of the anterior chamber, and as, in consequence of this, I could not very well see the pupil, I again desisted. On the 24th, I did that by which I had meant to complete the last operation. The blood had been absorbed, a speck remained on the back of the cornea where the adhesion had been, and the pupil I found, free as to the upper part, exposing, with an irregular margin, remains of lens-capsule, etc.; but no part quite clear that was not so before the anterior adhesion was divided, so that she still had vision only of large objects with this eye, but it was not necessary that they should be, as before, below its level. I passed in the cannula-scissors and one blade behind and below the (posterior) adhesion, which was all at one point, and so was easily severed at once: the lower part of the pupil which had been retracted to the shrunken lens then came forward to the level of the upper part, which, having been let go, by the former operation, from its adhesion anteriorly, had gone backward into its place. On the 31st, the eye had been painful, the pupil was occupied by iritic effusion; and the patient would leave the hospital. I never knew if the

pupil eventually cleared, or if vision was improved finally, for she did not come again to the hospital.

I have quoted this case because of its singularity, although it is so incomplete, and because some facts may be learnt from it: how difficult, for instance, it is to free the pupil from a posterior adhesion at the place of its attachment when the convex surface of the lens is lost, because it is unsupported,* and has receded, etc. I think it would be best in any case of adhesion to the cornea and to the lens, both for corelysis, that the latter should be first done, as the former would tend to remove the pupil from the lens to which, soon after detachment, there is so much predisposition to a re-adhesion.

P.S.—With another case, I will append a few remarks on extraction of cataract with adhesions of the pupil, especially to note a step preliminary to the removal of shrunken lens-capsule, with some remains of lens, in case of a long-precedent wound of the lens. I have alluded to cases of extraction through a closed pupil or one at some parts adherent to the cataract, cases in which the lens is simply opaque besides having pupil-adhesions, in which the operation is altogether clearly indicated and rather easily done, but the treatment of old traumatic cataracts is, at least in my opinion, much more difficult to be determined upon and pursued without some results which appear very dangerous or fatal: in the case I am supposing, the anterior and posterior parts of the lens-capsule, probably enclosing some opaque lens-matter, are in apposition or approximated with possibly at some part adhesion of the pupil: as in the last case I have given, this pupil-adhesion is not, like others, a simple attachment, but the pupil is there involved in the scar of the wound, and so, for one reason, the broad needle that is used, should be made to cut through it at its distal extremity instead of deferring it to the spatula-hook.

* This has much to do with many iris-operations, as in the case of iridodesis, at page 152, of the present volume.

Ellen Maelellan dressmaker, aged 18. On February 29th, in the present year, I operated on her right eye. When three years old, she was cutting card, her hand slipped, and the point of the small knife she was using ran into the eye: the remainder of the history given by her mother, was only that the eye was bloodshot for about a week and then it got well, but that she could not see and something grew over it: the doctor used lotions and other remedies but no operation had ever been done. She could tell light from dark with this eye but no shapes of objects: her mother said she was not to be depended on in placing things about the room, she put everything askew, that, for instance, she would put down her tea-cup just on the edge of the table and think it was right and safe. The appearance of the eye before the operation, the shrunken lens-capsule, and white remains of lens, to which at one part (probably that of the knife-

Fig. 5.



wound) the iris was retracted and bound down, is best given by the sketch I made as it then was, after applying to it atropine, I entered a small broad needle, as it had a cutting edge, at the outer and lower side of the corneal margin, passed it across the pupil and carefully divided the synechia as close as possible to the cataract, no bleeding occurred, and with the same needle I loosened the shrunken lens-capsule, etc., according to a plan I had determined on,—I passed the needle's point outside the margin of the lens-capsule at some one place and carried it inwards thence, detaching it inasmuch from its marginal connexions with the ciliary processes (diagram *a*, Fig. 6,) again and again I did this with the instrument at different parts of the definite circumference of the flattened lens, thus progressively bringing it towards the centre of the pupillary space; then I withdrew the needle, enlarging at the same time the corneal opening a little for the extraction of the shrunken lens, which I did next with cannula-foreeeps and without any difficulty or any injury, immediate or remote, as it was released from its old connexions. On April 17th all ciliary redness had disappeared, the pupil was clear and free, the iris acted well excepting at the part where it had been confined: *without a lens*, she could tell the time by a small watch, when held close to her: the eye looked natural, as the pupil was bright, although it was still lengthened horizontally: her mother said she used to have occasionally a *cast*, but, at this time, the eyes certainly moved together; and she also said her daughter no longer miscalculated distances and the position of objects: the patient herself remarked that she used to hold her work very much to her left side, but, since the operation, she could see it well straight before her.

In operations generally on old remains of lens-capsule, etc., in the pupillary area either long after operation for

cataract or wound of the lens, I have learnt to fear especially two consequences that are not uncommon or inconsiderable; either the protrusion of the vitreous humour into the pupil, through the opening made, or chronic inflammation in the ciliary region, perhaps consequent upon or coexistent with the former, or, as I have thought, by dragging upon the suspensory ligament: both of these ill-results may occur; the former on account of the transparency of the vitreous humour is often not known to have happened, and the latter is only manifested some time after the operation: once lately I discovered that the former had taken place by the bleeding which occurred from (?) the ciliary processes: the blood filled the empty aqueous chamber except in the centre, where the vitreous had come forward and was pressed against the back of the cornea (I had torn open, with two needles, some remains of capsule, left in the pupillary area, after extraction of cataract), the blood surrounded the vitreous as a red ring before the iris, and through the centre of the cornea, the clear vitreous humour and the pupil "opened out," the patient saw at that time very well. To obviate this projection of the vitreous humour into the aqueous chamber, which some have thought to be actually advantageous, when a false membrane (lens-capsule, etc.) is rent, as in the case I have just mentioned, the needles should not be passed farther than is just necessary through the membrane, or it should be divided with cannula-scissors: it should not be lacerated very extensively, or repeatedly, and in the cases also of old traumatic cataract (remains of lens and lens-capsule) once operated on, it is best to be satisfied with a fair result for vision although some portions remain in the pupil which might be removed; because these portions of lens-capsule, etc., after extraction or wound of the lens are *held in the ciliary region, by means of the (suspensory) ligament*, which has been perhaps confirmed and toughened by the former operations, and in their removal the vitreous humour is always likely to come forward, and perhaps also irritation of the ciliary body is induced. Considering this to be so,

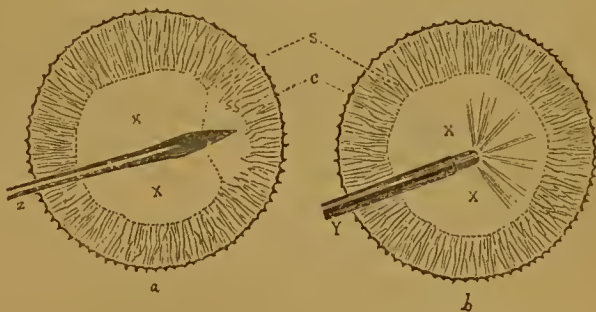
and the ill-results there have been, I devised the method of tearing through the ligament *in detail*, *before* attempting the removal of the obstructing lens-eapsule, etc., it is obvious that if it is seized at once by the foreeps, as it has been usual to do in these cases, the instrument has one-half, more

Fig. 6. *c*, ciliary processes; *s*, suspensory ligament; *xx*, *xx*, shrunken lens-capsule, remains of lens, etc.

a, shows the manner of separating with the needle (*z*) the lens-capsule at its margin, in detail.

b., shows how advantageously the cannula-forceps (*y*), are *opposed* by the retaining influence of the suspensory ligament, in such a case as the foregoing.

Fig. 6.



or less, of the suspensory ligament opposed at once to its traction and acting very favourably *against* the removal (diagram, *b*, Fig. 6,) thus in fact, it is well adapted to support the healthy lens, and as I have said, it is, in an abnormal state, probably strengthened; however, with force applied at some one part of the ligament it is easily there torn through and the needle-point will effect this at various parts, and so entirely separate the lens-eapsule, etc., and leave it to be removed with the cannula-forceps, with little disturbance of the vitreous humour and without irritation of the ciliary body. In other surgical operations the *gradual* separation of parts to be removed is the rule whenever it is applicable, and in ophthalmic surgery it is often to be followed: the iris itself must not be dragged upon to a great extent at once; and so, in corelysis, as I have said, I have always avoided its ciliary separation (iridodialysis), or any laceration of its substance in detaching the strongest adhesions of the pupil, *by taking them in detail*. See paragraph 15.

REPORT

ON CASES OF CATARACT TREATED BY "LINEAR EXTRACTION,"
AT THE ROYAL LONDON OPHTHALMIC HOSPITAL,
FROM APRIL 1857, TO MAY 1860.

BY DR. BADER, *Curator and Registrar.*

THE term linear-extraction has been substituted for that used by Mr. Gibson of "extraction of cataract through a small puncture in the cornea" (see page 103, of his "Practical Observations on the formation of an Artificial Pupil," etc., London, 1811).

The numerous cases (112), to facilitate the Report, have been subdivided into cases of—

- congenital* cataract, (32 cases);
- cataract of *various* origins, (19 cases);
- cataract in secondary and hereditary *syphilitic* persons, (16 cases);
- traumatic* cataract, (45 cases).

The Report is confined to the operation and its complications, and only gives in outline its results as to vision, etc.

The technical part of the operation (which in several points differs from that performed by Mr. Gibson), has repeatedly been described; it will, therefore, be sufficient to enlarge upon the accidents which have happened, during and after the operation, and to mention the remarks respectively made by the operators at the time.

The youngest of the 32 *cases of congenital cataract* was 3 months, the oldest 30 years of age: the form of cataract exactly coincided in both these cases, in both the central portion of the thickness of the lens was opaque. The opacity had a conical shape, its apex apparently (O.S.) resting on the inner anterior and its base on the inner posterior surface of the lens-capsule. This opacity had in the younger case a pale grey opaque, in the older a chalky white opaque appearance, and in the latter case there were a few peripheral striæ. The cataract was confined to one (L) eye in one case, in it the central portion of the lens was faintly grey and opaque.

An equally grey-white, round flat opacity on the anterior central surface of the lens was observed in 12 cases, a similar one on the posterior surface of the lens (in the hyaloid fossa?)

in 2 cases. Numerous small dots of white-grey opaque colour sprinkled in the anterior surface of the lens existed in 6 cases.

A central grey-opaque dot, at some distance from the transparent surface of the lens in one case, and a flat, equally grey opaque lens in 5 cases, was noticed.

Both eyes were operated on in two-thirds of the cases, and simultaneously in most: one eye only was operated upon when the vision of the fellow-eye appeared still to be satisfactory.

Vision of the eye operated on was restored in from two to six months after the operation. The escape of vitreous, posterior or anterior synechiæ, repeated linear-extractions of remnant lens-portions protracted the recovery of the cases. Chloroform was given in most cases: the straining accompanying it was, in 2 cases, followed by escape of vitreous, in one by bleeding into the anterior chamber: the blood was at once removed, so as to prevent its clotting.

Repeated operations with the small needle in a few cases, preceded the linear-extraction. Iritis followed the operation in one case, without any final ill-result. Suppuration of one of the eyes operated on (at 9 and 4 years), followed in two cases, in both the opacity appeared to be far behind the pupil, in the posterior surface of the lens: both eyes had been operated upon as usual, the right eye in the one, and the left in the other case: the vitreous advanced into the anterior chamber, and many fragments of the opaque lens surrounded by vitreous, and receding before the scoop were left behind (an accident which sometimes has happened): pus appeared on the iris, in the pupil, and in the anterior chamber on the third day, and suppuration of the lower half of the cornea, with escape of pus from the vitreous space ensued on the sixth day: both eyes shrunk subsequently: the fellow-eyes recovered good vision. An eye with a similar deep-seated opacity (then called congenital cataract) had been dissected some time previously to the above two suppurations: it was found that the deep-seated opacity was due to an expansion of an opaque fibrous string, which, from the optic nerve and yellow spot, advanced through the vitreous space to the hyaloid fossa, where it expanded: it enclosed numerous small bloodvessels, and its presence appeared due to an arrest of development of the vitreous space, etc.: the retina readily became displaced from the choroid on dragging the anterior expansion of the string: the greater part of this eye is preserved in the Museum of the Hospital. We add the

following ease, to give an idea of some of the troubles accompanying the operation—one eye only was operated upon, the small grey-white dots on the anterior surface of the lens were easily detached (as usual), with their corresponding portions of capsule, when touched with the needle, and the remainder of the anterior surface of the lens was broken up: linear-extraction was performed a week afterwards, and in another week the patient was dismissed with an active pupil and with a small quantity of grey lens-substance behind its area. One month later there existed extensive posterior synechiæ: these were broken through with the small needle: numerous grey opaque floeculi of lens-substance were observed a fortnight later in the pupillary area and in the anterior chamber. A second linear-extraction was performed. The following was the state of the eye after another week: a large anterior chamber, the iris pushed backwards, the pupil glued to the capsule, its area contracted and fixed but clear. A month later the adhesions of the iris were broken through with two needles, after which the iris resumed its normal position, though it remained tremulous. Small bits of lens-capsule, enclosing opaque particles of lens-substance, remained attached to the pupillary margin, without materially impairing its movements.

An active, clear pupil, a normal anterior chamber and good vision were the final results of the ease.

19 *Cases of Cataract of various origin* in middle-aged persons.—No cause could be traced in 13 of these cases: in 12 of them it was confined to one eye. In 2 cases it appeared during a voyage in the tropics: of these it was, in one, accompanied by flashes of light, hemorrhage into the vitreous space and partial displacement of the retina. In one case it appeared (in one eye) after continued work at gold, pearls, etc., and in another it was ascribed to numerous attacks of ophthalmia, which for fourteen years returned twice at regular intervals in both eyes, and which in one eye became complicated with cataract: the patient, a girl of 19, stated that the attacks of ophthalmia began after vaccination, when 5 years old. One case of cataract which followed repeated attacks of bronchitis, was complicated with results of choroiditis (synechiæ, yellow fluid in the aqueous chamber, etc.): it was first broken up with the needle and then removed with the seop: the operation was followed by an attack of iritis, and vision finally was slightly improved.

The lens had a uniform light-grey opaque (soft) appear-

ancee in 12 cases: the tension of the eye, and the size of the anterior chamber offered no peculiarities. In 5 cases the lens was swollen, and the iris bulging forwards: in these the lens had a greyish translucent appearance, and was overlaid by silvery-white opaque peripheral striæ.

A grey opaque lens nucleus, with peripheral grey opaque striæ, the intermediate lens-substance being transparent (left eye), was observed in a woman (aged 44), whose sight began to fail some time after she had left off suckling: there was sugar in the urine at the time. The opaque nucleus, on breaking up the surface of the lens with a needle, advanced into the pupil: it did not create irritation, and was, with the remainder of the opaque flocculent lens-substance, removed three days later by linear-extraction: the eye recovered well from the operation.

All the greyish translucent lenses escaped readily: the average time of recovery of sight was from 4 to 6 weeks. Repeated operations were required to remove the grey opaque more glutinous lenses: the average time of recovery of sight was from 6 to 10 weeks.

The girl, in whom the cataract formed a complication of the attacks of ophthalmia (following vaccination), recovered useful vision after a good deal of trouble: the first operation (linear-extraction), was followed by a severe attack of ophthalmia: leeches were applied three times within a fortnight: the vitreous advanced into the anterior chamber after a second linear-extraction (14 days after the first): it receded spontaneously, leaving the pupil clear and (after 8 weeks) moveable, without posterior synechiæ: tenderness on pressure on the ciliary region, continued for two months, when vision was already becoming useful.

Cataract in Syphilitic Patients.—11 of the 16 syphilitic cases had the typical marks of *hereditary* syphilis: the patients were between the ages of 8 and 17: the remaining five cases were suffering from *secondary* syphilis during which the cataract began: in 4 in both, and 1 in one eye: in four cases the lens had a uniform grey opaque colour: in the fifth case a tripartite grey opacity was at first observed on the middle of the anterior surface of the lens, this opacity after the third visit of the patient had extended over the anterior surface of the lens, and was in appearance similar to that of the other 4 cases.

In the hereditary syphilitic cases, small superficial portions

of the lens appeared chiefly altered, the bulk of the lens being either transparent or very faintly-grayish opaque (admitting of a fair illumination of the vitreous space); but the portion of the lens nearest the anterior capsule being sprinkled with one or more minute, chalky-white, or silvery-white, or gray-opaque, very small round well-defined dots. Remnants of specific keratitis were observed in 8 of the above cases.

One of the cases (in a patient aged 17) was complicated with elongation of the eye backwards (the fellow eye being myopic); the lens was opaque, shrivelled up into a roundish irregular-edged silvery-white opaque substance: the greater part of it was removed with the cannula-foreeps: the few gray opaque flocculi which appeared some days after the operation were left: the eye finally recovered useful vision. The nucleus of the lens of one of the secondary syphilitic cases fell into the anterior chamber: it caused no irritation: it was removed 2 months later. Closure of the pupil followed in two other cases: it was opened out with 2 needles. Vision was restored in these syphilitic cases in from 1 to 3 months.

In all the hereditary syphilitic cases, 2 excepted, both eyes were affected, but only those were operated upon in which the opacities in the lens materially interfered with vision. The small opaque dots above mentioned, easily detached with their corresponding portions of capsule from the surface of the lens. Those eyes, of which the bulk of the lens was only slightly opaque, made the quickest progress (*i.e.* the separation of the lens from its capsule ensued completely) of these, 3 had recovered vision 14 days after the operation. The cases in which the bulk of the lens was transparent were very troublesome: in one the operation was followed by an attack of specific keratitis, and in 3 by an attack of iritis with lymph in the iris and pupil (3 days after the operation). Softening of the vitreous, with signs of atrophy of the eye (with an attack of iritis in the fellow eye) appeared 10 months after the commencement of the iritis in the eye operated on.

Of the 45 cases of Traumatic cataract 16 were of long standing, *i.e.* the eyes had been injured a considerable time ago (old cases of traumatic cataract: injury at from 6 months to 25 years ago), 32 were fresh cases, the patients applying within a period of from several days to 2 months after the injury: the latter may be again divided into those in which the traumatic cataract was the only visible defect of the eye

(simple cases of traumatic cataract), and those complicated with diminution or abolition of the anterior chamber, with or without perforations of the cornea, wounds of the iris, displacement of the opaque lens, etc. Of this latter group there were 11 cases (complicated cases of traumatic cataract).

Simple cases of traumatic cataract.

The average duration of recovery of these cases was from 2 weeks to 2 months: one of the cases was 60 years of age. Iritis (serous) followed the operation in one case (recovery after 1 month); and a severe attack of ophthalmia with chemosis in 2 other cases (recovery after 5 weeks).

In one case an attempt was made to make the lens particles escape from the anterior chamber by injecting tepid water through the corneal wound: the water regurgitated without reaching the particles (recovery 1 month later).

Complicated cases of traumatic cataract.

Vision of the injured eye was lost after the operation in 2 cases (subsequent shrinking without any active inflammatory symptoms): the others recovered within 2—4 months.

The lens had been dislocated in one case: its lower margin projected into the pupil. The preliminary needle operation was followed by sickness, vomiting, and pain in the eye: these symptoms at once subsided after linear-extraction.

No anterior chamber existed in 8 cases: in 4 of these the cornea had been perforated by foreign substances: the swollen lens appeared in the other cases to account for the loss of the anterior chamber: the chamber was in all cases restored within a week after linear-extraction: in 7 it was filled by aqueous, in one by vitreous humour (the pupil being black, irregular, well-defined, hardly moveable, and the iris pushed backwards).

Escape of vitreous, before the lens had entirely been removed, occurred in one case (recovery).

Old cases of traumatic cataract.

In most of these cases the lens had shrunk to a flat gray opaque, or to a dead white opaque flat substance: it assumed a flocculent appearance after having been touched with the needle: in most cases the capsule was found to be very tough: the patients (3 excepted) recovered useful vision in from 3 weeks to 3 months.

Vision was but slightly improved in a case of myopia (at the age of 34), in which the eye had been injured by a blow 4 years previously: vision became gradually misty. The surface of the lens was sprinkled with minute gray opaque

dots and with numerous peripheral striæ. The vitreous at once advanced into the anterior chamber after escape of the aqueous, displacing the opaque lens-particles behind the iris. A week later the aqueous was found to be slightly yellowish, and the pupillary area occupied by the gray opaque lens-particles : most of these were removed by a second linear extraction, though the vitreous advanced again, closing round the scoop : the vision of this patient was finally improved.

In another case (suffering from consumption) in which the eye had been injured 4 years previously by a blow, the lens had a dirty gray yellow opaque appearance : it became flocculent after having been touched with the needle : only a few flocculi escaped during the operation, the bulk of the lens sinking back into the vitreous chamber : some of the yellowish slightly viscid vitreous (?) escaped. No irritation followed : the flocculent lens had risen again behind the pupil : it was brought forward with the scoop, and was then removed by an enlarged incision in the cornea.

In a third case (injury, blow 1 year before), the hard nucleus of the lens was (enclosed by gray opaque lens-substance and by a tough lens-capsule) crushed with the cannula forceps, and, like the remainder, removed through the small incision in the cornea.

Traumatic cataracts, with abolition of the anterior chamber, and soft cataracts, where the lens was grayish and translucent (so that one could see into it to a certain depth) were the most satisfactory cases. The former, because the anterior chamber was speedily re-established ; the latter, because the lens-substance escaped readily, and only very slightly adhered to the capsule.

The degree of inflammation, which followed linear-extraction, appeared to be more severe when the more healthy lens-substance had been displaced or left behind. The posterior synechiæ, and the irregularities and impaired movements of the pupil, disappeared in many cases after a considerable time.

The operation was repeated 2 or 3 times, at intervals of from 3 days to 2 weeks, on eyes, in which the quantity of opaque lens-substance appeared to justify such proceeding. In some cases (of children) the lens-capsule also was removed with the cannula-forceps : in others, only as much lens-substance was allowed to escape as would readily come out by making the corneal incision gape, on withdrawing the broad needle. The escape of opaque lens-substance was facilitated by

gently pressing with the forceps, with which the eye was fixed. The eye was closed for a minute and gentle friction applied to the lid, when lens-substance had been displaced behind the iris towards the ciliary processes: this, in some cases, succeeded in bringing it forwards into the anterior chamber.

Suppuration in the tract of the puncture in the cornea has been observed in 2 cases (with subsequent small opacity) and a deposit of small particles of lime at the bottom of the anterior chamber in 2 other cases.

Spontaneous bleeding, from the anterior surface of the iris, occurred during the operation in 2 cases (followed by recovery). Prolapse of the iris by the incision into the cornea occurred in 7 cases: the prolapse receded spontaneously in 1 case, and on exposure to light (some hours after the operation) in 2 cases. Bulging of the iris, after the corneal incision had healed, was in 2 cases caused by lens-particles behind the iris.

Adhesions of detached portions of lens-capsule enclosing opaque lens-particles, or of the latter alone to the pupillary margin, without materially impairing the movements of the iris, were observed in five cases.

More or less extensive adhesions between the pupil, or the posterior surface of the iris and the capsule (posterior synechiæ) have occurred in two-thirds of the cases. The fluid which fills the anterior and posterior chambers after linear-extraction appears in these cases changed: it becomes more glutinous, and the capsule being in contact with the iris, becomes glued to it. Part or the whole of the posterior chamber may thus become excluded from the anterior, and bulging of portions or of the entire iris, by fluid, or by retained lens-particles, etc., may occur. It is desirable that these synechiæ should be divided.

Attacks of iritis, or of severe ophthalmia, were treated by leeches, instillations of atropine, cold and rest. In a very few cases only the whole of the lens was removed by the first linear-extraction: in some cases of traumatic cataract (judging from what had escaped) as much as two-thirds of the lens were left, in others a whole segment of the lens, in others the part nearest the posterior capsule or near its periphery. In three cases the central portion of the posterior capsule became glued to the rent in the anterior, and the latter to the pupillary margin, thus excluding the posterior chamber as well as enclosing lens-substance in its peripheral parts.

Such accidents account for the appearance of opaque flocculent lens-substance after the capsule had been opened



1



2



5



3



4

PLATE XI.

Of the upper part of the Plate the central figure—

X. Y. Z. shows the ordinary ophthalmoscopic appearance of the (cupped) entrance of the optic nerve and neighbouring parts of the case related at p. 241; in it—

X. Z. are veins, and

Y. an artery,

a. b. a long white mark, having the appearance of a separation or rupture in the red choroid.

A. the apparent alteration (of position) of the two *veins* X. Z. *in the cup*, when the ophthalmoscopic lens, in the hand of the observer, was moved upwards.

B. ditto—moved downwards.

C. „ — „ to the right (*of the observer.*)

D. „ — „ to the left „

U. shows the collapsed bloodlessness of the veins *in the cup* when the eye of the patient was *slightly* pressed upon by the observer. X. Z. the veins, Y. the artery.

V. is intended to represent the ordinary appearance of the artery in the cup and at its margin at the time when, with the pulse, it was filled. Y. the artery (X. Z. the veins).

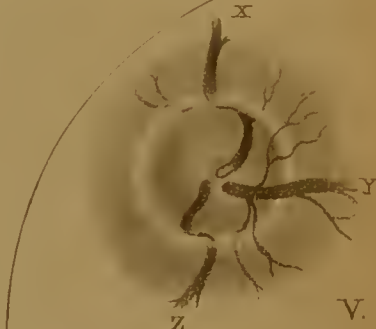
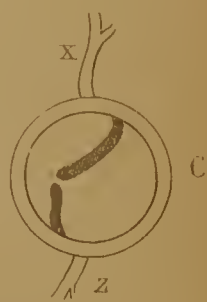
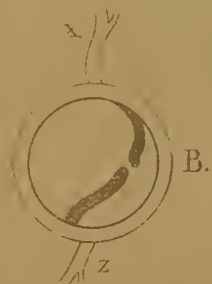
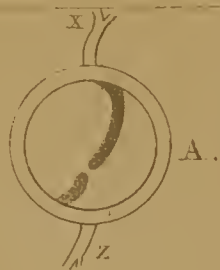
M. a magnified (3 times) sketch of the iris and semi-transparent occluding membrane filling the pupil of the left eye, of James Mussel, see p. 335.

N. the pupil of the same eye, after the operation: the occluding membrane being retired to the outer side.

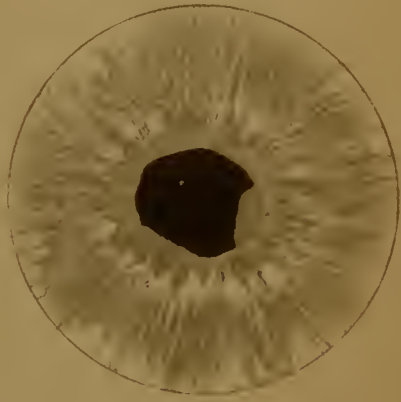
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PLATE
XI.

APRIL
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- x 3 -



M.

N.

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